

THREE ESSAYS ON GROWTH AND DEVELOPMENT WITH FINANCIAL MARKET

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The objective of this dissertation is to understand the role of financial market in economic development, particularly its economy-wide impact on income inequality, poverty, and employment. To accomplish this task, a dynamic computable general equilibrium (FCGE) model with linkage to the financial market is constructed, which conforms to the specific developing economy analyzed in this dissertation.

In the first chapter, I construct the model to evaluate the distribution and poverty impact of saving and investment imbalances. I apply the model framework to a financial social accounting matrix data from Indonesia, an open market economy that has experienced persistent trend of excessive domestic savings since the 1997 East Asia financial crisis. The model is calibrated for 2006-10 such that the equilibrium solutions reproduce benchmark data on key macroeconomic indicators. Counterfactual scenarios are simulated to derive conclusions about the implication of excess saving on macroeconomic performances and welfare. The results indicate that when banks increase their portfolio share of risk-free financial assets, credit channeled to private sector's investment is reduced, which leads to higher income inequality, slower pace of poverty reduction, and higher rate of unemployment. I conclude that an expansionary monetary policy offers an effective way to respond an excess saving trend in order to achieve sustainable and equitable growth.

The second chapter examines rebalancing strategies for sustainable and inclusive growth in Indonesia. It has been revealed in the previous chapter that excess saving trend in the aftermath of the 1997 financial crisis has ripple effects on income distribution, poverty reduction, and employment creation. Therefore, policy options that emphasize the quality and growth of both private and public investment should be of utmost importance to improve saving and investment imbalances in the economy. Further rebalancing efforts should also include promoting more public spending in rural areas, enhancing good governance on public outlays, increasing economic efficiency and productivity, sharpening comparative advantage, and expanding intra-regional trade. Finally, counterfactual scenarios are experimented with the use of dynamic FCGE model to highlight the significance of developing Indonesia's capital goods industries in order to reduce reliance on imports and increase employment in productive sectors.

In the third chapter, an extended version of the dynamic FCGE model is employed to examine asset price bubble and evaluate its policy implication. Using general equilibrium as a basis for analysis, I generate an endogenous stock price bubble in the model economy through balance sheet adjustments. If corporate sector were to limit its leverage activities, excessive asset growth could be avoided and stability of the macroeconomic performances would be maintained. However, such case does not typically apply to low interest rate condition and strong business cycle trend, so I investigate policy simulations for fiscal restriction, monetary contraction, and policy mix to mitigate the impact of potential repercussions that stock price bubble can generate in the economy. The results indicate that standalone monetary policy is the most favorable option to implement corrective measures in preserving the natural growth of output, consumption and investment while minimizing the deteriorating welfare impact of policy enactment.

BIOGRAPHICAL SKETCH

Inka Yusgiantoro was born in May 24, 1975 in Semarang, Indonesia. He grew up in Prabumulih and Jakarta before moving to Colorado, USA when he was eleven years old. He graduated from Heritage High School in Littleton and subsequently began his undergraduate study at the University of Michigan, Ann Arbor in the fall of 1992. He received a Bachelor of Science in Engineering degree from the Department of Industrial and Operations Engineering in April 1996, and continued to Columbia University to obtain a Master of Science degree in Operation Research in May 1997. After graduation, he moved back to Indonesia to work as an Operation Engineer in the country's first independent power producer company. Several years later, he embarked on a new career in Singapore to work for Credit Suisse First Boston in the corporate finance division, and subsequently relocated to New York City, USA to work for Merrill Lynch and Company as an Associate Investment Banking in Global Industries Group. In the fall of 2003, he decided to return to graduate school at the University of Michigan, Ann Arbor where he earned a Master of Science degree in Financial Engineering. In 2004, he worked as an economic analyst at Sempra Energy Company in San Diego, and in the following year he decided to start his doctoral program at Cornell University in the Graduate Field of Regional Science. He earned a Master of Arts degree in 2010, and since August 2011, he has been a Research Fellow in the John F. Kennedy School of Government, Harvard University.

Untuk Mami dan Papi

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CHAPTER 1

THE ROLE OF FINANCIAL ASSETS ON INCOME INEQUALITY AND POVERTY

1.1. Introduction

There have been numerous studies in the economic development literature to improve the distribution of income and reduction of poverty in developing countries. Most of the factors analyzed, however, are in the category of resource endowments, institution's development, and redistribution policies. While these effects are undoubtedly important, other factors deserve a further look. In particular, the impact of saving and investment imbalances on economic development should be of great interest for developing countries.

How do saving and investment imbalances affect income distribution, poverty, and employment? What is the most prevalent mechanism that they can contribute to the worsening welfare of the population?

To exploit the mechanism, one can start by observing at the macroeconomic trends following the East Asia financial crisis in 1997. After the crisis, most developing economies in East Asia have experienced a significant reversal in their patterns of saving and investment imbalances.¹ With relatively high domestic rate of savings and precipitous decline in private investment, aggregate domestic savings in the crisis-hit countries have grown larger than aggregate investment in the real sector. The excessive savings have apparently benefitted developing economies, reflected by their large trade surpluses and substantial accumulation of foreign exchange reserves in the aftermath of the crisis. However, the remarkable reversal in the

¹ See Azis and Lamberte (2010) for specific trend and component of the saving and investment imbalances in Indonesia, Thailand, and the Philippines.

saving and investment imbalances has raised three key issues for the developing countries in the region.

First, there is a strong indication for excess liquidity (i.e., savings) characterized by faster growth of investment in financial assets than in the real sector. This trend is widely expected given the rapid growth of financial markets in the region, which provides more attractive investment opportunities for businesses and investors. Nevertheless, large capital inflows can drive up asset price excessively that may lead to a ‘bubble’ economy. In the event of a bubble crash, asset value takes a drastic plunge and institutions’ balance sheet will severely be damaged by the collapse of the market.

Second, the growth of financial assets should help strengthen domestic financial market and accelerate private investment. However, since the productive activities of a country depend on the real sector, the efficacy of the economy to generate faster pace of output growth with higher employment may not be realized. Economic growth requires investment in new capital goods and the upgrading and replacement of older capital, but new funds raised in the capital markets may not necessarily transform into expansion of factories and creation of new employment. Businesses and investors can utilize the new funds to relinquish debt and interest payments while others may have greater incentives to invest into bonds and other risk-free assets to secure consistent return.

Third, to the extent that financial market has had a differential impact on the income of the rich households relative to their poor counterparts—particularly during market boom—, the implication that financial assets has for equity improvement in developing economies becomes very important. As domestic institutions become increasingly active in the financial market, some segments of the population, primarily the high-income group (i.e., the investors), must

have received financial gain, while the income position of others, namely the low-income group, remain unaffected. This condition is most prevalent during strong business cycles growth (i.e., stock market boom) and can significantly affect the income distribution of the population.

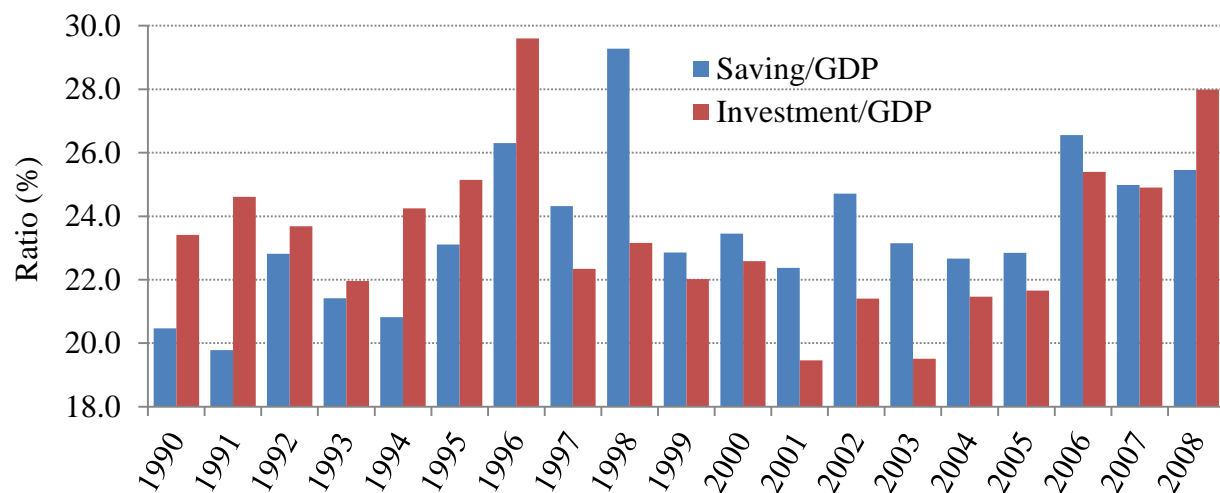
From the perspective of developing countries, the latter issue is of utmost importance in order to balance growth and equity objectives. Financial investors are typically classified as rich urban households working in financial and services sectors, while their counterparts are the poor rural households working in agricultural sector. Thus, when urban investors obtain interest payments and dividends from their financial investment, the income inequality of the two groups of household will most likely be affected.

As a result, excessive domestic savings absorbed in financial assets can generate adverse impact on the welfare of the population. Many other important factors can play a role in widening income disparity, such as institution's development (Chinn and Ito, 2006), asset concentration (Claessens, Djankov, and Lang, 1999), and redistribution policies, but the significant reversal in saving and investment imbalances has surely reinforced the increasing trend of income inequality in East Asia since the 1997 financial crisis.

The main purpose of this chapter is to examine the important role of financial market on income inequality, poverty, and employment in a developing country. The subtle linkage between the real sector and financial market will be captured explicitly by the savings and investment of various institutions in the economy. To illustrate this purpose, actual case from Indonesia will be applied. Indonesia is an important case study in economic development both by virtue of the size of its open market and for the lessons it may offer to other developing economies.

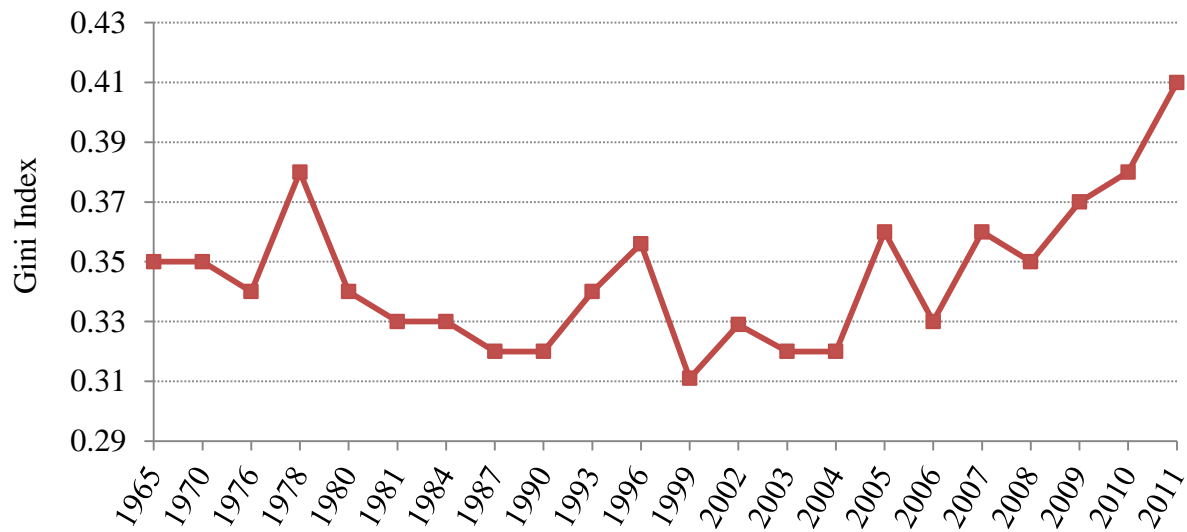
Prior to the 1997 crisis, Indonesia had experienced saving deficits due to its high rate of investment. The trend was then reversed after the crisis, and since 1998, the biggest economy in Southeast Asia had generated surpluses in domestic savings through 2007 (see Figure 1.1). This reversal of the saving and investment imbalances is also followed by increasing trend of Gini index and declining employment elasticity across most sectors in the economy (see Figure 1.2 and 1.3). Hence, to analyze the impact of the excess saving trend on economic welfare, an economy-wide model of the computable general equilibrium type will be constructed in this chapter.

The chapter is organized as follows. Section 1.2 describes the data framework to the base model used in this dissertation. Section 1.3 outlines the structure of the model in detail. Section 1.4 describes the counterfactual scenarios and policy simulations. Sensitivity experiments to check the robustness of these results are discussed in Section 1.5. Section 1.6 concludes the chapter.



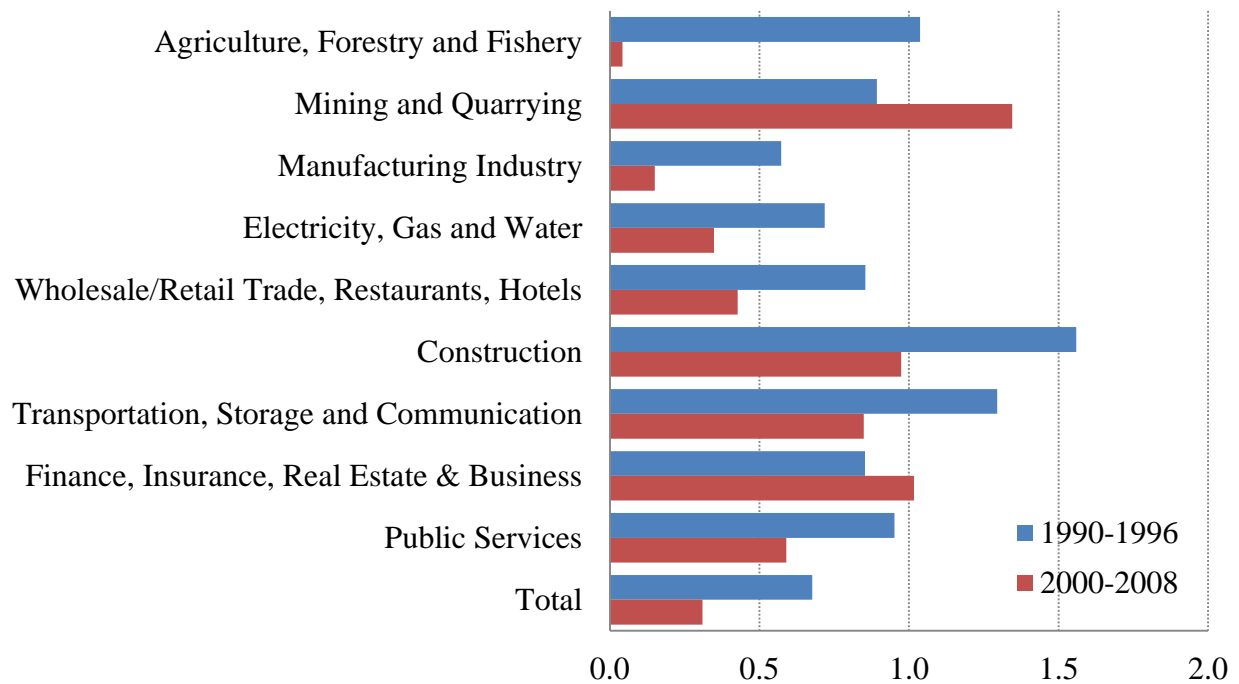
Source: Annual flow of funds, Bank of Indonesia.

Figure 1.1: Ratio of Real Investment and Domestic Saving to GDP, 1990 to 2008



Source: Central Bureau of Statistics, Indonesia.

Figure 1.2: Trend of Gini Index in Indonesia, 1965-2011



Source: Author's calculation from employment data, Central Bureau of Statistics, Indonesia.

Figure 1.3: Employment Elasticity by Sector, 1990 to 2008

1.2. Data

The primary data for the model is the latest financial social accounting matrix (FSAM) for Indonesia in 2005, produced by a joint collaboration between the central bank (i.e., Bank Indonesia) and Central Bureau of Statistics (BPS).² The FSAM 2005 is a square matrix, 79-by-79, data table that describes linkages between factors of production, institutions, sectors, and the financial market. Rows in the matrix indicate income, while columns show account expenditure.

The accounts of the FSAM data system are classified into two production factors (labor and non-labor), nine institutions with their corresponding capital account, nine production sectors and commodities classified into domestic and imported goods and services, trade margin and transportation cost, indirect taxes and subsidies, 17 types of financial instruments, and rest of the world account. The nine institutions are central bank, commercial banks, non-bank financial corporations, non-financial corporations, government, and four household groups classified into poor-rich and rural-urban categories. The nine production sectors, consisting of both formal and informal categories, are agriculture (which includes livestock, forestry and fishery), mining and quarrying, petroleum and non-petroleum manufacturing, utilities (which includes electricity, gas and water supply), construction, trade (which includes hotel and restaurant), transportation and telecommunication, finance (which includes real estate and business services), and other services (which includes public services). The financial instruments consist of the central bank's official reserves asset, currencies, demand deposit, savings deposit, domestic time deposit, central bank certificates (SBI)³, government bond, other long-term non-government securities, short-term securities issued by both government and private sector, working capital credit, investment

² The English edition of Indonesia's FSAM 2005 table can be downloaded at Bank Indonesia's website: <http://www.bi.go.id/web/en/Publikasi/Publikasi+Lain/Publikasi+Lainnya/FSAM.htm>.

³ SBI (Sertifikat Bank Indonesia) is a debt certificate that may be used by the central bank to reclaim its share of net foreign asset (NFA) and form government debt instruments in order to secure greater control on foreign reserves.

credit, consumption credit, non-bank credit, trade credit, stock and equity (which includes common and preferred stocks issued by corporations, and other equities), insurance and pension fund reserves, and other financial instruments.

Furthermore, additional sets of data are used to complement the FSAM, such as the initial factor demand by each production sector, initial capital stock and investment by sector of destination, initial rate of return for each type of financial instrument, nominal exchange rate, and open unemployment rate. Since the FSAM data is a flow representation of all existing monetary transactions in the economy during the year, separate data on the initial stock of asset, liabilities, and fixed asset (i.e., gross fixed capital formation) are also used to determine the balance sheet of each institution at the end of the base year.

Under FSAM framework, the relationship between the real sector and financial market can be explained using the capital account, which records the institution's savings in the economy. Physical investment (fixed asset) and portfolio investment (financial asset) are financed by these savings along with bank loan, bond issuance, and deposit withdrawal.

Consequently, by setting the FSAM 2005 data system as a base year equilibrium benchmark, a dynamic financial computable general equilibrium (FCGE) model for Indonesia can be constructed upon which prices are endogenous and behavioral equations are imposed. The next section describes the model in detail.

1.3. The Model Framework

The basic structure of the FCGE model follows closely that of Azis (2002), which originated from a model developed by Thorbecke, et al. (1992). The model in this chapter

specifies both neo-classical and structuralist features to conform more closely to the underlying structure and behavior of agents in the economy. All agents are assumed to be rational; that is, the consumers maximize their utility and producers maximize their profit, subject to the constraints they encounter. The demand for factors and commodities is then solved from the agents' optimization problem.

There are a total of 1,285 equations in the model, the complete list of which is shown in the Appendix of this dissertation. All of the equations define the consistency of the general equilibrium framework and are altogether divided into 16 blocks. The first 11 blocks formalize the real sector of the economy (e.g., factor market, production, trade, etc.) while the remaining blocks replicate the working of the financial market. The details of each block are described in the following sections.

1.3.1. Prices

The domestic price of import (PM_i) is marked up by an import tariff and import trade and transportation margin rate, as well as a downward adjustment of import subsidy share (Eq. 1). On the contrary, the domestic price of export (PE_i) is adjusted upward by export subsidy share (Eq. 2). World export and import prices are set exogenous to reflect a small open economy in the world trade market.

In this block, prices are also expressed through a set of equations corresponding to equilibrium prices. For example, Eq. 3 shows the equilibrium supply ($PQ_i \cdot Q_i$) and demand for composite goods in the economy, in which the latter consists of domestically sold goods and import demand ($PD_i \cdot D_i + PM_i \cdot M_i$). A similar notion applies to Eq. 4 to 6. In order to arrive at

the equilibrium supply for domestically produced goods ($PX_i \cdot X_i$), the price of domestic sales (PD_i) is adjusted by the relevant market distortion parameters (i.e., indirect tax rate, domestic trade and transportation margin, and imperfect competition index), while production subsidy (SUB_i) is added to the total demand for domestic goods. Meanwhile, the supply for value added ($PV_i \cdot VA_i$) is determined by the demand for domestic production less intermediate composite input. The supply of this intermediate composite input ($PINTM_i \cdot INTM_i$) is expressed as the sum of the demand for domestic and imported intermediate input, whose prices are determined by the derived input-output coefficients from the FSAM data (Eq. 7 and 8).

The price of capital investment (PK_i) is specified in terms of the weighted sum of the costs of investment goods (Eq. 9), while the price index ($PINDEX$) is defined as the ratio of nominal to real output to track the direction and magnitude of movements in consumer prices (Eq. 10).

1.3.2. Market Distortion

This block specifies the relevant distortion variables that can affect production and trade in the goods market, which consists of domestic and import trade and transportation margin (Eq. 11 and 12), indirect tax from commodities (Eq. 15), import tariff (Eq. 16), imperfect competition (Eq. 17), and export-import subsidies (Eq. 18 and 19). The total trade and transportation margin received is expressed in terms of the weighted sum of the margins collected from the respective production sector (Eq. 13 and 14).

1.3.3. Production and Intermediate Input

In this block, a set of nested constant elasticity of substitution (CES) functions is imposed for the production structure of the economy (Figure 1.4). At the initial stage, value added (VA_i) is determined as a CES function of factor demand ($FACDEM_{i,f}$) with constant productivity variable (avx_i), as shown in Eq. 22. Thus, the demand for intermediate input ($INTM_i$) is determined by the derived first order condition of the CES function with respect to the value added and their relative prices (Eq. 21). A similar conditionality applies to Eq. 25 to solve for the optimal composition of domestic and imported intermediate input (Eq. 23). The supply of intermediate use is expressed as the weighted sum of domestic and imported intermediate input (Eq. 26).

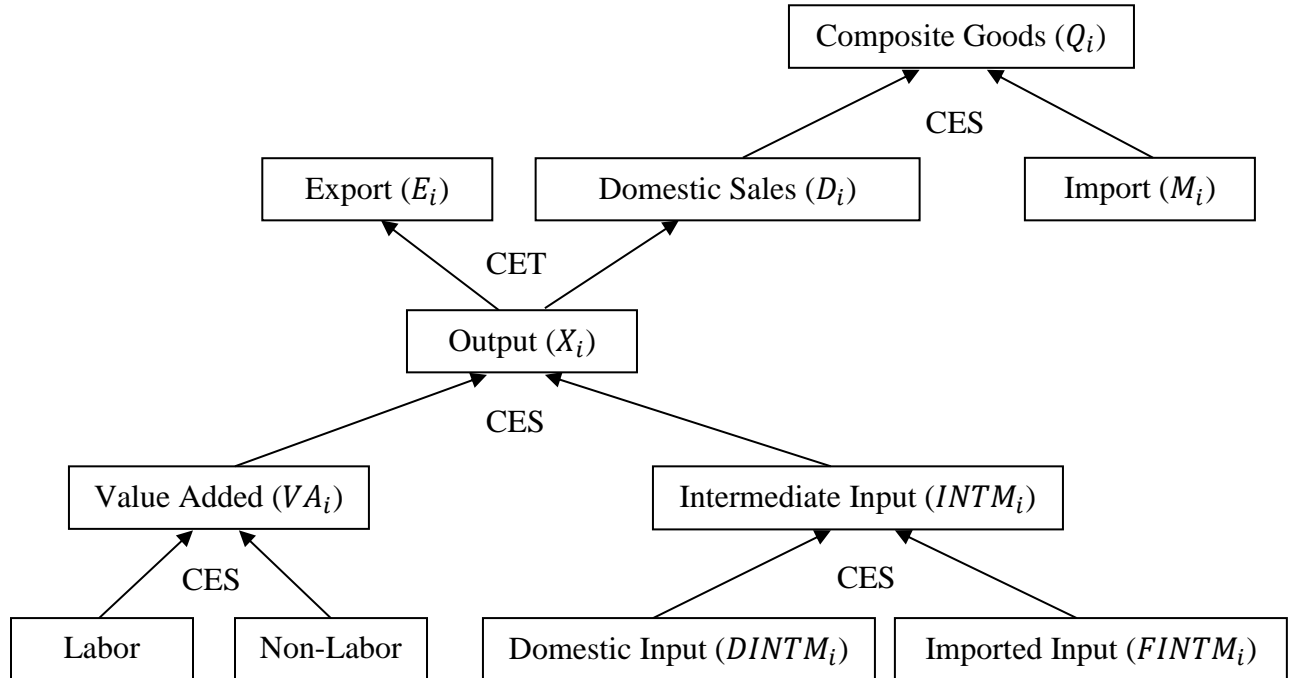


Figure 1.4: Nested Structure of Production in Goods Market

In the second stage, domestic production (X_i) from each sector is specified as a CES function of value added and composite intermediate input (Eq. 20). This particular specification allows both input composition and value added-to-output ratio to vary when external shocks occur in the economy.

The domestically sold goods (D_i) and exports (E_i) are substitutable, but with cost. Hence, a constant elasticity of transformation (CET) function is imposed in the third stage of the nested structure (Eq. 30). By revenue maximization on domestic production (i.e., maximizing Eq. 30 with respect to Eq. 4), the sales composition of domestic goods (i.e., domestically sold goods and export) can be determined by Eq. 32. No income effects are taken into account; that is, the export-to-domestic sales ratio is determined entirely by their relative prices.

In the final stage, following Armington (1969), the demand for composite goods (Q_i) is determined by a CES function of imports and domestically produced goods (Eq. 27). This aggregation implies that simultaneous activities to export and import commodities (i.e., cross-hauling) are allowed. In effect, the specification avoids the tendency for price equalization since domestic prices are independent of the fixed world prices (i.e., a small open economy assumption in the model). Similar to the notion of export-to-domestic sales ratio, income effects are also not allowed. Finally, minimizing the cost of acquired composite goods provides the first order conditionality in which the ratio of import-to-domestic sales is determined by their relative prices (Eq. 29).

1.3.4. Labor Market and Migration

The labor market condition in the model departs from neoclassical setting such that wages are determined by an independent equation that consists of the inflation rate, relative prices of the value added production, and the growth of labor productivity (Eq. 34). This specification implies that labor market segmentation exists with wages being differentiated according to the specific sector of the economy. Meanwhile, the average labor price (WF_{fl}) is derived on the basis of the wage rate and wage share in each sector (Eq. 35), while the price for non-labor factor is solved in the model in order to clear the factor market (i.e., by equating supply and demand with no excess demand and supply allowed).

Factor demand ($FACDEM_{i,f}$) from each sector is defined by the value added production, factor price, and factor productivity (Eq. 33). In turn, this factor demand along with factor price and exogenous payments received from foreign sources ($YFROW_{f,fr}$) will determine factor income (YF_f), as specified in Eq. 36.

In this block, a specific distortion variable for factor price ($WFDIST_{i,f}$) is defined to reflect the actual prices in developing countries, where, in a perfect mobility case, the variable is equal to unity for all sectors. This specification deviates from the traditional economic theory that factor prices will tend to equalize and converge to the average factor prices due to factor mobility across sectors.

Finally, labor migration behavior is characterized by the changes in labor demand to reflect labor opportunity, which is derived by the growth ratio of labor demand in sector's destination to the labor demand in sector's origin (Eq. 37). Eq. 39 ensures that total in-migration equates to total out-migration.

1.3.5. Income

In this block, transaction flows accrued from all factor contribution (i.e., wages and rent) and inter-institution transfers are specified to determine the income of the non-government institutions, which includes the household group (Eq. 40). Factor contribution is transformed into a portion of income for each institution through a fixed share parameter ($factoin_{in,f}$). Similar specification also applies to Eq. 41 through 43 to determine the specific income of the urban high-income household, government revenue, and the income of foreign institution.

Consequently, the following two equations are added into the model in order to measure the income inequality of the population.

$$YDISTRU = \sum_{ruh} INC_{ruh} / \sum_{urh} INC_{urh}$$

$$YDISTLH = \sum_{ph} INC_{ph} / \sum_{rh} INC_{rh}$$

where $YDISTRU$ is the income inequality ratio between the rural and urban household groups, and $YDISTLH$ is the income inequality ratio between the poor and rich household groups. Hence, a decrease in the ratio reflects worsening condition while an increase in the ratio defines improvement in the equity distribution of the population.

1.3.6. Inter-institution Transfer

Total monetary transfer for each institution ($ITRAN_{in,in2}$) is expressed in Eq. 45 as the sum of the institution's transfer to the government ($GTRAN_{gin,din}$), monetary return from the financial market ($RTRAN_{in,in2}$), and other monetary transfer among institutions ($OTRAN_{in,in2}$). Institution's transfer to the government is collected in the form of direct taxes, derived from taxable share of the endogenous income in Eq. 44.

Monetary return from the financial market is specified as the proportion of the total value of return-earning financial assets held by the institution (Eq. 48). Eq. 47 defines the share of holding the return-earning assets for each institution ($RNshare_{in}$). The inclusion of financial return in the household income, most notably the urban high-income household group (i.e., through stock dividends and interest payments), should affect the income inequality of the population when external shocks occur in the economy.

1.3.7. Expenditure and Saving

Total flows of transaction accrued to monetary transfer among institutions will determine the expenditure for domestic non-government non-household institution (Eq. 51). Similar specification applies to Eq. 52 through 54 to compute the expenditure of the household, government, and foreign institution. In addition to inter-institution transfer, household consumption ($YCONS_h$) and direct taxes ($DIRTAX_{gin,din}$) are added to the household expenditure. For government expenditure, the demand for final goods ($PQ_i \cdot GD_i$) and total subsidies are added, while total export ($\sum_i (PWE_i \cdot E_i \cdot EXR)$) and inward remittances ($\sum_f YFROW_{f,fr}$) are added to the expenditure of foreign institution.

Household consumption is measured on the basis of marginal propensity to save (MPS_h) and disposable income less transfer to non-government institutions and rest of the world (Eq. 50). Disposable income is defined as the household's net income after tax ($INC_h - \sum_{gin} DIRTAX_{gin,h}$). Meanwhile, MPS_h is expressed through an independent behavior equation that conforms to the household's preference to save when the composite interest rate for savings and time deposit is higher than the initial rate (Eq. 49). This interest rate ($rna1_h$) is specified

from the average rate of return of both savings and time deposit for the household institution (Eq. 80).

Accordingly, savings are determined by the difference between income and expenditure of each institution (Eq. 55). The total sum of all savings makes up aggregate saving (Eq. 56), the magnitude of which, if the model is appropriately constructed, should equate aggregate investment as defined by Walras' law.

1.3.8. Investment and Aggregate Demand

In this block, the model makes a detour from the Walrasian general equilibrium framework such that the domestic private investment is specified as a function of the value added production, share of bank loan to the private sector, and the exchange rate (Eq. 58). The shift parameter ($\lambda_{0,i,firm}$) of the equation is calibrated by the model, while share parameters for the three dependent variables ($\lambda_{1,i}, \lambda_{2,i}, \lambda_{3,i}$) are determined by an independent econometric work in which the estimated values for each sector of destination are depicted in Table 1.1.

The reduced form specification in Eq. 58 reflects the importance of credit channel and balance sheet effect on gross fixed capital formation. Therefore, corporate's decision to invest in the real sector is directly determined by the actual share of bank loan disbursed to the private sector and nominal change of the exchange rate, in addition to changes in the demand for value added goods. Accordingly, private investment in this model is not particularly affected by the market interest rate, but rather by the bank credit as determined from the asset composition and net worth of the lenders (i.e., commercial banks) and borrowers (i.e., non-financial corporations).

Table 1.1: Estimation of Share Parameter for Value Added, Loan Share, and Exchange Rate

	$\lambda 1_i$	$\lambda 2_i$	$\lambda 3_i$
Agriculture, Livestock, Forestry and Fishery	0.824	3.578	1.080
Mining and Quarrying	0.027	3.690	0.285
Manufacturing	1.152	4.943	-0.130
Electricity, Gas and Water Supply	0.860	0.918	-0.495
Construction	0.935	0.682	0.326
Trade, Hotel and Restaurant	1.110	1.021	-0.557
Transportation and Telecommunication	1.141	0.460	-0.038
Finance, Real Estate and Business Services	0.220	1.178	-0.078
Other Services	2.048	0.366	-0.149

Source: Author's estimation.

The sum of investment from each institution to each production sector makes up the aggregate investment (Eq. 59), the magnitude of which, if the model is appropriately constructed, should equate aggregate saving. Given the specification of the investment equation described above, the FCGE model constructed in this chapter adopts an investment-driven macro closure, a feature considered more relevant to developing countries such as Indonesia.

In terms of aggregate demand, private consumption (CD_i) is derived from standard utility maximization, in which a Cobb-Douglas function with fixed expenditure share ($\alpha q_{i,h}$) is adopted (Eq. 60). Government demand for goods and services (GD_i) and government investment ($INVES_{i,gin}$) are set as policy variables (i.e., exogenous variables) in the model. The latter assumption conforms to the notion that government investment is primarily used to develop infrastructure and financing public programs. Hence, the allocation of funds is made based upon the government's evaluation of the sector's need for investment, and is hence considered a policy instrument in the model.

The price and quantity of capital investment ($PK_i \cdot DK_i$) in each sector of destination are determined by the sector's fixed share ($kshr_i$) of the aggregate investment (Eq. 61). Using external data on capital stock and investment, a coefficient matrix for capital investment ($capmat_{i,j}$) is then specified in order to determine the investment demand (ID_i) in each sector of destination (Eq. 62). Through changes in the investment demand, the next period capital stock ($KSTOCK_{t+1}$) can be determined, which plays a pivotal role in the inter-temporal feature of the model.

1.3.9. Real Sector Equilibrium

This block represents the balance of payment and the supply and demand in goods market and factor market.⁴ The goods market equilibrium specifies the supply of final composite goods to equate the sum of the demand for intermediate goods, private consumption, government demand, investment demand, and received trade and transportation margin (Eq. 63). Equilibrium

⁴ Note that equilibrium in the labor market entails unemployment due to the model specification.

condition for the factor market matches the factor supply to the sum of the factor demand from each sector of destination (Eq. 64).

Furthermore, the supply of labor ($LSUP$) is adjusted accordingly by the growth rate of the labor force and net migration derived in the labor market block (Eq. 65).⁵ With the derived labor supply and changes in the labor demand, the unemployment rate ($UEMPR$) is specified in Eq. 66. Finally, Eq. 67 specifies the equilibrium in the balance of payment, in which the current account (i.e., export less import with net foreign transfer) must equate the capital account in a given year. This specification implies that foreign savings ($FSAV$) can be a good proxy for the net capital flows in the model economy.

1.3.10. Gross Domestic Product

The gross domestic product at current price (GDP) is expressed in terms of the sum of value added for all production activities, indirect taxes, and tariff less subsidies (Eq. 68). The gross domestic product at constant price ($RGDP$) is derived from the expenditure side, which is the sum of the private consumption, government demand, investment demand, and net export (Eq. 69).

1.3.11. Poverty Line

The measure of poverty in this model is determined on the basis of endogenous income and poverty line (Azis, 2008). Poverty line (PL_{ph}) is defined as the level of income below which

⁵ The supply of labor ($LSUP$) will be set exogenous in the inter-temporal setting of the model, which will be discussed later in Section 1.3.17.

household cannot afford to purchase a basket of basic goods that yield threshold caloric requirements. Hence, the ‘price’ for poverty line can be expressed in terms of the relative prices of the composite price index and the average domestic price ($PDAVG$), along with the total basic goods consumed by the poor household (Eq. 71). A consumption pattern matrix for the poor household ($\sum_i \alpha pov_{i,ph}$) is computed from the FSAM data and used to specify the basic goods consumed by the poor. A similar notion applies for the poverty line of the population ($PLTOT$), which uses consumption pattern matrix for the whole household group (Eq. 72).

Accordingly, poverty incidence can be estimated by comparing the endogenous price of poverty line and the endogenous income of the poor households. For example, a significant increase in the income of the poor which exceeds the rise of poverty line will result in the likelihood of reduced poverty in the population. On the contrary, a small increase in the income of the poor that remains below the prevailing poverty line will result in the likelihood of higher poverty incidence.

In the following five sections, blocks relating to financial assets are discussed to replicate the working of an open market economy with financial sector. Aggregate saving and aggregate investment are the important key variables linking the real sector to the financial market (see Figure 1.5).

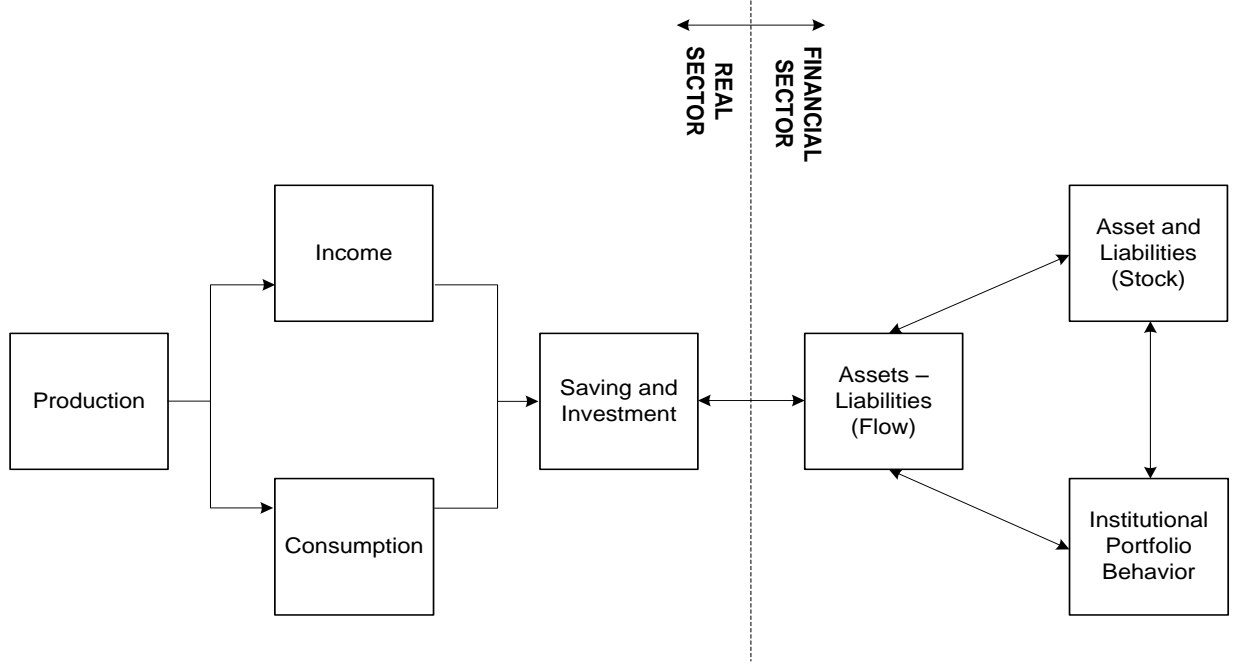


Figure 1.5: Interdependence of the Real Sector and Financial Market

1.3.12. Financial Market Equilibrium

This block represents the balance sheet equilibrium for the stock-flow relation of the financial assets. The stock of asset at the end of the period ($AssetS_{as,in}$) is expressed as the sum of the initial stock of asset at the beginning of the period ($AssetSLag_{as,in}$) and the total flow of asset ($Asset_{as,in}$) during the time period (Eq. 73). A similar notion applies to Eq. 74 through 76 to determine the end-of-period stock of liabilities ($LiabS_{in,as}$), fixed asset ($FixAS_{in}$), and wealth ($Wealth_{in}$) for each institution. Fixed asset ($FixA_{in}$) is expressed as the sum of investment by sector of destination (Eq. 77). The wealth ($WealF_{in}$) of each institution constitutes the saving of that particular institution in the given period (Eq. 78). The equilibrium of the balance sheet for each institution is specified in Eq. 79.

A composite interest rate for non-money demand assets ($r_{nv1_{in}}$), or assets that are not classified as currency and demand deposit, is specified based upon the average rate of return of the assets' stock at the beginning of the period (Eq. 81). The same specification applies to Eq. 82 to determine the average rate of return for all return-earning assets in the financial market ($AvgRN$).

1.3.13. Demand and Supply of Financial Assets

In this block, the rate of return for some financial assets determines the equilibrium supply and demand of the assets in the market, as specified in Eq. 87 through 90. These assets are classified into 'ast1' and 'ast2' type. The 'ast1' asset type consists of all of the credit instruments in the market, namely the working capital credit, investment credit, consumption credit, non-bank credit, and trade credit. For example, the supply of consumption credit to households follows the demand for that credit type and its given rate of return (RN_{ascr}) in the market. Meanwhile, the 'ast2' asset type consists of SBI, short-term commercial paper, long-term corporate bond, insurance and pension funds. Hence, the demand for SBI is determined by how much that central bank's instrument is offered in the market at its given rate of return (RN_{assbi}).

A similar notion applies to the foreign exchange reserves and other non-tradable assets in the market, in which the latter is classified as 'astq' asset type in the block. Hence, the rate of return for foreign reserves ($RN_{asf_{xr}}$) and asset 'astq' (RN_{astq}) are set exogenous to determine the equilibrium supply and demand of the corresponding assets, in which the stock of the assets must equate to the stock of liabilities in the market (Eq. 83 and 96).

The demand for money (i.e., currency and demand deposit) by each institution is expressed in terms of the income of the corresponding institution and the average rate of return for non-money demand assets, where the share parameter α 's are constant (Eq. 84). Thus, the stock of money demand assets held in portfolio is determined by a fixed share of the institution's demand and supply for money, while the corresponding rate of return (RN_{asmd}) is fixed (Eq. 85 and 86).

Finally, not all rate of return for the financial assets are set exogenous in the model. In particular, the rate of return for saving and time deposit (RN_{asdp}), government bond (RN_{asgb}), and equities (RN_{aseq}) are allowed to vary in order to determine the equilibrium demand and supply of those particular assets, as specified in Eq. 91 through 95. The 'ast3' asset type consists of saving and time deposit, while equities and government bond are represented in the 'ast4' and 'aste' asset type, respectively. The next section describes the financial mechanism of Tobin portfolio allocation in detail when the asset's rate of return is determined to be endogenous (Tobin, 1970).

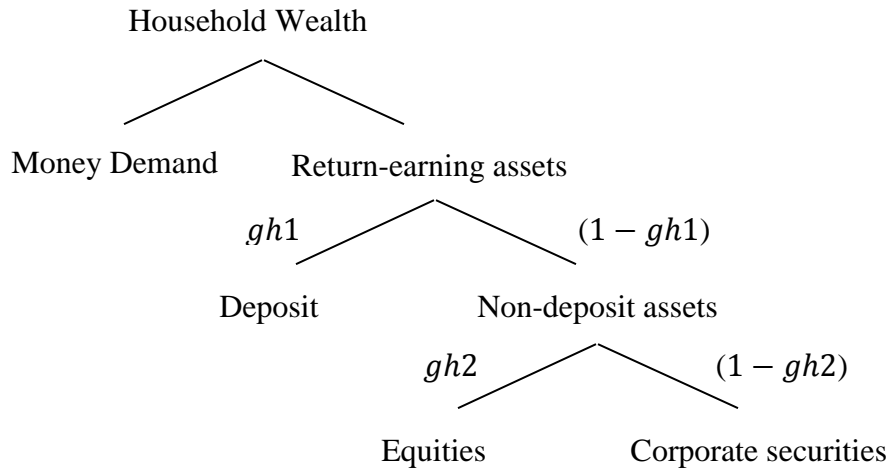
1.3.14. Tobin Portfolio Allocation

Tobin portfolio allocation is specified on the basis of a hierarchical process in order to impose imperfect substitution among the financial assets.⁶ The selection order of the financial assets in the hierarchy is determined based upon the ranking of asset values in the portfolio holding of the institution at the beginning of the year. Thus, the relative rate of return for the relevant assets will determine the institution's preference to allocate those assets in its portfolio in the following year. Eq. 97 through 105 specifies the average rate of return for each type of

⁶ See Bourguignon, Brandon and de Melo (1989) and Thorbecke et al. (1992).

assets in the market. The last two equations define the rate of return for non-deposit ($RNNDP$) and non-equity assets ($RNNEQ$), respectively.

Figure 1.6 shows the Tobin portfolio allocation decision for the household institution. In this model, only the household groups are selected to follow the specified financial mechanism in order to reduce computational complexity. The primary assets in the hierarchy consist of saving and time deposit, equities, short-term commercial paper, and long-term corporate bond due to their large shares in the household portfolio at the beginning of the period.



Note: $0 < gh1, gh2 < 1$.

Figure 1.6: Asset Allocation in Household's Portfolio

At the initial level, household wealth is allocated between money demand assets (i.e., currency and demand deposit) and return-earning assets. The latter is further allocated proportionally between deposit (i.e., saving and time deposit) and non-deposit assets based upon the share variable $gh1$, as specified in Eq. 106. This variable is derived from the relative rate of

return for the two corresponding types of asset ($RNDP$ and $RNNDP$) in the household's portfolio. The allocated proportion of the deposit is then determined in Eq. 108 from the remaining household wealth after deducting for fixed asset, money demand asset, and the sum of other asset holding not considered in the hierarchy process (i.e., SBI, government bond, credit, insurance, pension funds, and other non-tradable assets).

The portfolio allocation decision is repeated at the next level with the share variable $gh2$ between equities and non-equity assets, which is derived by the relative rate of return for both types of asset ($RNEQ$ and $RNNEQ$) in the portfolio (Eq. 107). Similarly, the allocated proportion of equities is determined in Eq. 109 from the remaining household wealth after deducting for fixed asset, money demand asset, and the sum of other assets holding. Eq. 110 specifies the allocated proportion for corporate securities (i.e., short-term commercial paper and long-term corporate bond) to reflect the remaining non-equity assets in the hierarchy process. However, if more assets were considered in the household portfolio, then the Tobin portfolio allocation decision would continue based upon the hierarchical process described earlier until it reaches the last pair-wise comparison of the assets.

Accordingly, the wealth for the household group ($WEALH_h$) and other institutions are specified in Eq. 111 through 116.

1.3.15. Money Market Equilibrium

The total supply of money ($M2S$) is determined by the money multiplier and central bank's reserve money (Eq. 119). The central bank influences money multiplier through the minimum reserve requirement, set at 5 percent, while currency is expressed in terms of the ratio of currency to total money demand assets in the economy (Eq. 117). The total money demand

($M2D$), often referred to as ‘broad money’, is comprised of currency, demand deposit, saving deposit, and time deposit (Eq. 121). The money market equilibrium is specified in Eq. 122.

1.3.16. Credit Channel

This block emphasizes the role of credit channel linked to the domestic private investment described earlier in Eq. 58. Fluctuations of credit growth exist due to changes in the supply and demand for loanable funds, both of which can be influenced by the financial structure of lenders (i.e., financial intermediaries) and borrowers (i.e., non-bank firms). When firms are also taking the role of lenders to other firms, frictions in the credit market are likely to amplify, propagating real and nominal shocks to the economy (Stiglitz and Greenwald, 2004). Therefore, unlike in the traditional economics theory, the new underlying premise in this model framework is that credit, not interest rate, plays a central role in determining aggregate activities. However, the actual allocation of credit is critically dependent on the judgments of lenders concerning the risk associated with borrowers.

As a result, actual loan share to the private sector is primarily influenced by the net worth of borrowers as well as the asset composition and the net worth of lenders specified in Eq. 126. The first bracket in the right-hand-side of the equation reflects the balance sheet position of the non-bank firms (i.e., as a borrower), while the second and third brackets denote the proportion of bank’s holding for risk-free assets, namely SBI and government bond. The last term on the right-hand-side captures bank’s net worth (i.e., as a lender). Hence, a depressed value of borrower’s net worth leads to a lower amount of credit to the borrower, and so does a high proportion of risk-free assets in the lender’s total asset.

Accordingly, the actual amount of credit supplied to the corporate sector through the credit channel mechanism ($CCLOAN_{firm}$) is specified in Eq. 127. This actual amount of bank loan conforms to a more practical view of the credit market than that ($BANKLOAN_{firm}$) derived in Eq. 125. Meanwhile, the total bank's loanable funds available ($BANKF$) is expressed in Eq. 124, which consists of the proportion of bank's assets that are not classified as risk-free assets.

1.3.17. The Dynamic Calibration

The inter-temporal feature of the model is based on recursive dynamics, in which decisions in the current period rely on a set of parameters based upon past and current state, but not on future state. As a result, the model is solved one period at a time by solving a sequence of time recursive solutions.

The main feature of the recursive dynamic mechanism is the equation of motion that incorporates the depreciation of the total capital stock ($KSTOCK$) and the accumulation rate of the aggregate investment in the last period ($TIDLag$), as well as the updating of the model's time-dependent variables, which include the stock of asset, liabilities, fixed asset and wealth for each institution and financial asset (Eq. 128 and 129). In addition, the growth of labor supply ($LSUP$) is set exogenous to follow the annual growth of labor force in the country, whereas the government demand rate (GD_i) is equated to the realized growth for public expenditure in each year. As a result, the actual performance of Indonesia's economy in 2006-10 is captured explicitly through a set of parameter and exogenous variable adjustments for which the time paths of major macroeconomic variables have been traced.

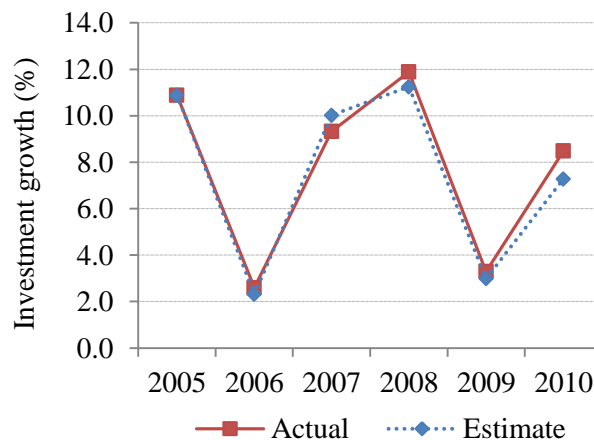
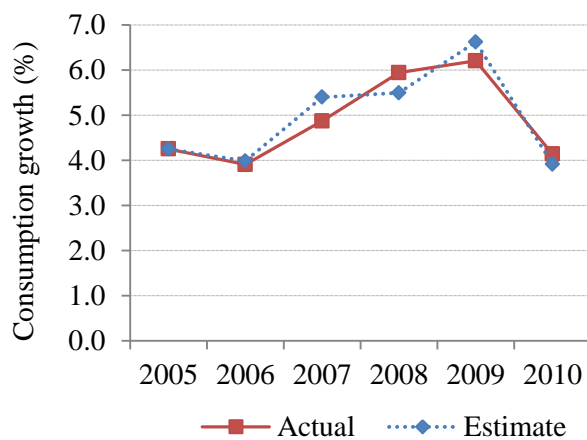
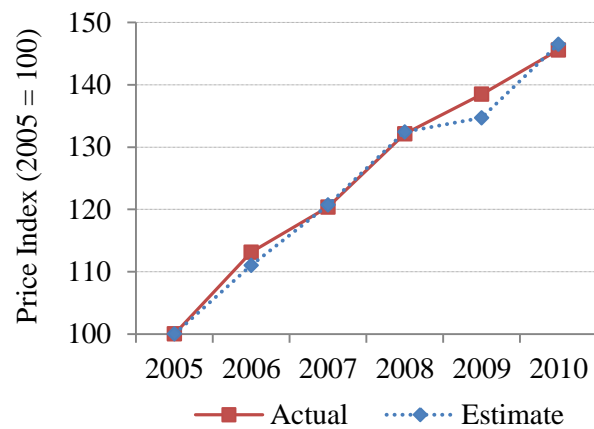
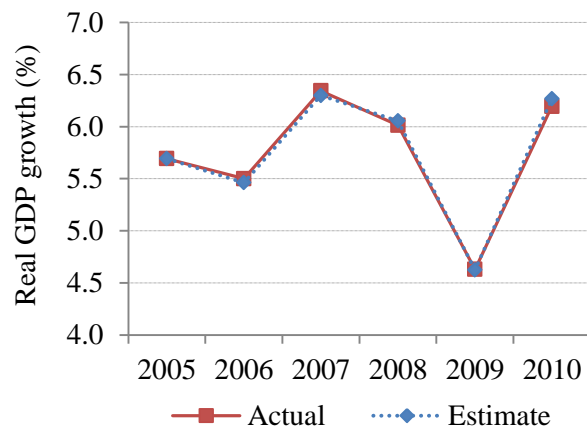
Several major shocks are worth noting. In March and October 2005, the Government of Indonesia increased the subsidized domestic fuel prices substantially to reduce the mounting pressure on its fiscal capacity due to escalating world energy price (PWM_i is adjusted upward).⁷ Consequently, an expansionary policy was enacted with fiscal stimulus package enacted through the year 2006 (GD_i increases). Budgetary savings from the fuel price increase were used to support stimulus package for 10 percent increase in the personal income tax threshold (lower $dtax_{gin,h}$) and tariff reduction on agricultural import commodities (lower tm_{AGRI}). Capital inflows remained significant ($FSAV$ is adjusted downward) while transitory shock from higher production costs continued through the year (higher ρx_i).

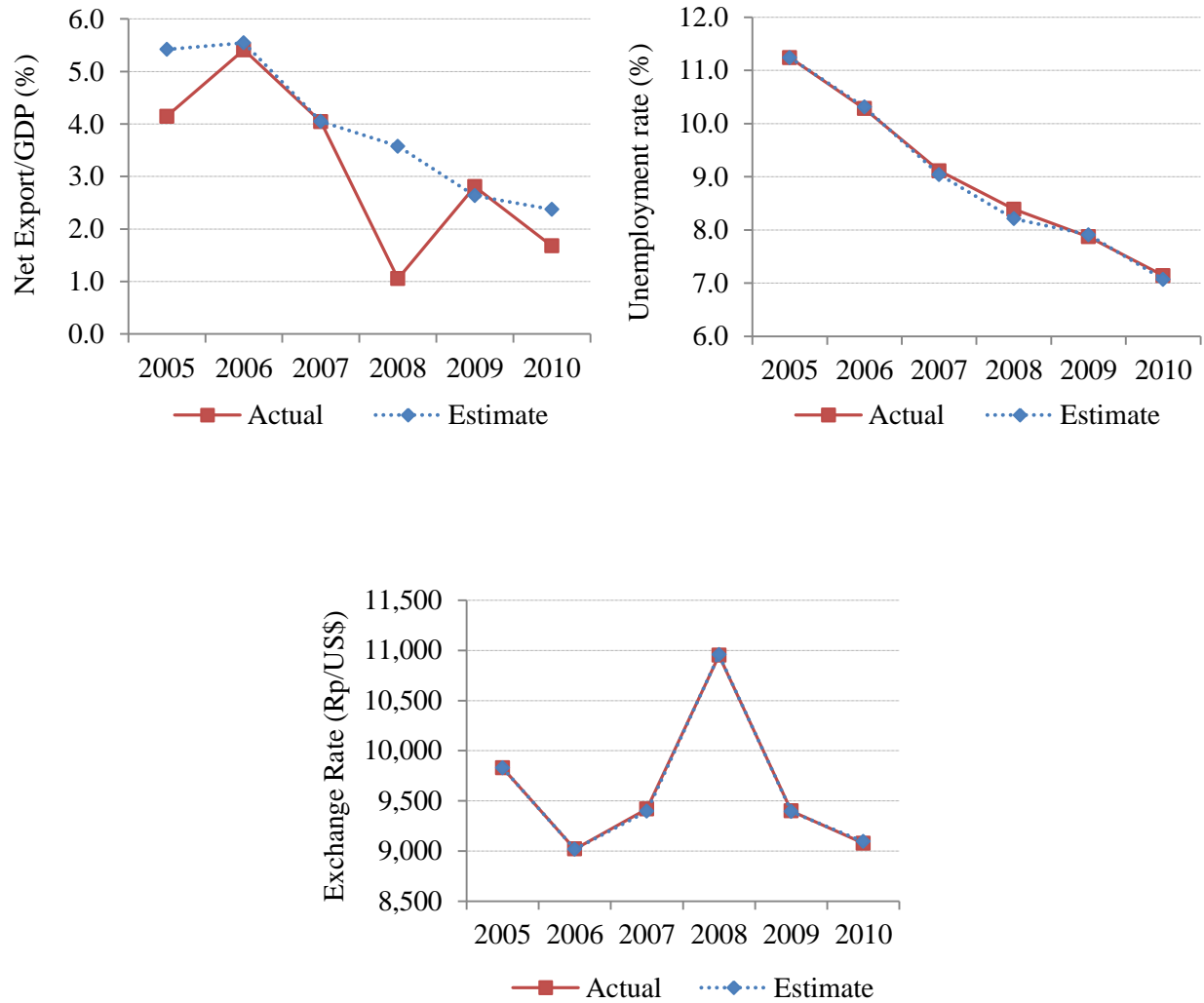
Furthermore, a capital account shock from the outflows of private capital occurred in 2008 during the global financial crisis, which resulted in a considerable depreciation of the rupiah (EXR increases). Falling global demand on export goods also marked decreasing trend in the world price of import and export (PWM_i and PWE_i are adjusted downward), leading to lower production costs through the year (lower ρx_i). Consequently, an expansionary policy was enacted with fiscal stimulus package exceeding US\$ 7.5 billion (GD_i increases) that included reduction in import tariff (lower tm_i). Benchmark interest rate was also cut at the fastest pace in decades by 300 basis points into a five-year low of 6.50 percent through 2009.

The values generated from the dynamic calibration are compared and validated with the actual rate of growth for selected macroeconomic indicators, such as the real GDP, gross investment, private consumption, inflation rate, unemployment rate, and the exchange rate (see Figure 1.7). As an illustration, the percentage differences between the actual and estimated

⁷ The October adjustment was the largest increase Indonesia had ever experienced, with gasoline prices raised by 88 percent, diesel by 105 percent and kerosene by 186 percent. As a result, average domestic fuel prices reached about 75 percent of international price level.

values for real GDP and private consumption in 2010 are -1.15 and 5.36 percent, respectively. Other indicators also point to close proximity between the actual and estimated values, which indicate the dynamic FCGE model has a fairly good tracking capability to emulate Indonesia's economy between 2006 and 2010.





Source: Central Bureau of Statistics, Indonesia and results of model calibration.

Figure 1.7: Trends of Selected Macroeconomic Variables

Using General Algebraic Modeling System (GAMS) application, all of the equations in the dynamic FCGE model are solved simultaneously to give numerical result. This result constitutes the ‘base run’ dynamic scenario, which should precisely represent the original FSAM data in the base year and trace the actual macroeconomic performance of the country between 2006 and 2010. Any new shock to the exogenous variables and/or parameters can be numerically

analyzed as a ‘simulation’ scenario compared to the base run scenario. The next section discusses the counterfactual simulations.

1.4. Simulation Results

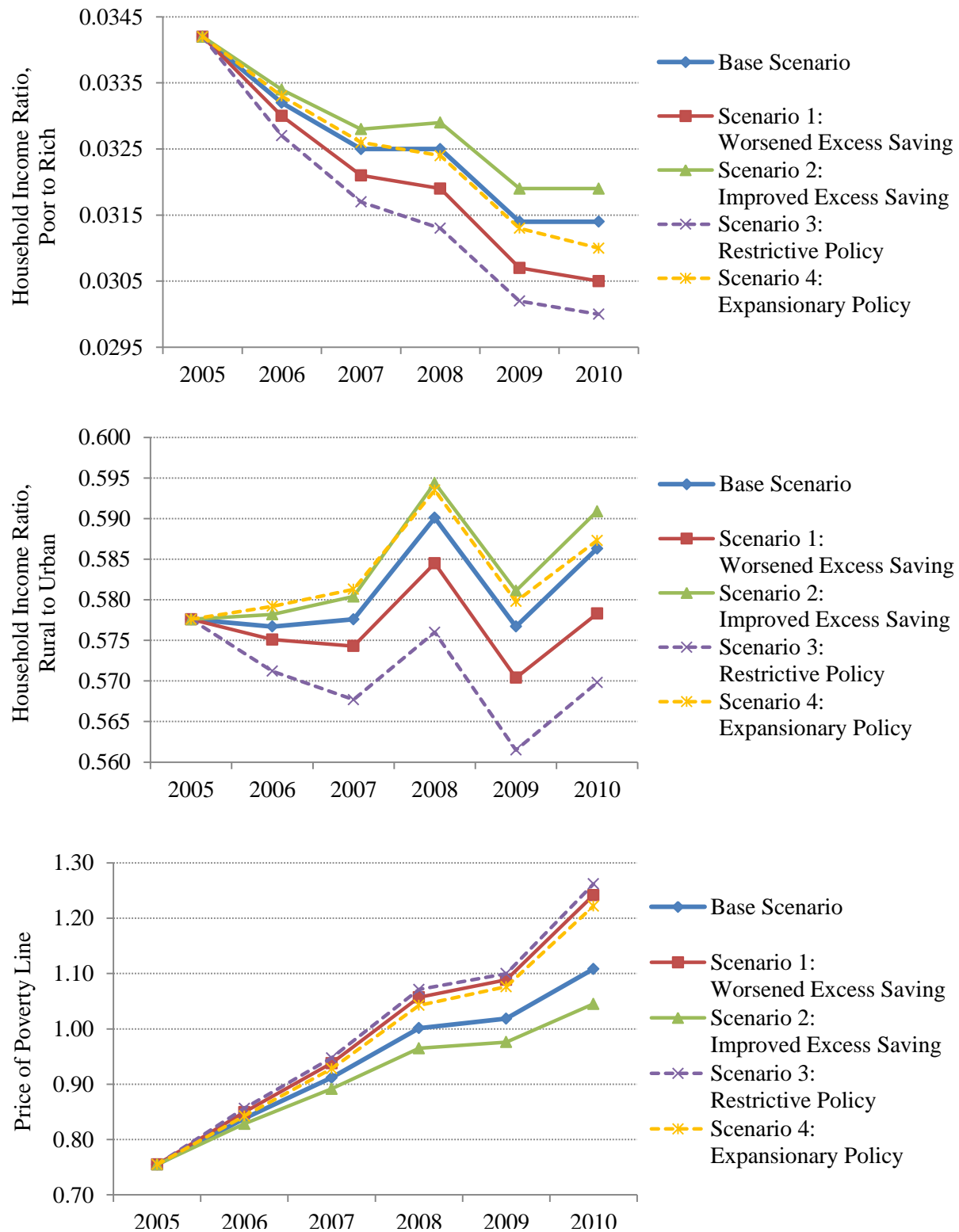
Consider the actual case in Indonesia where the significant reversal in saving and investment imbalances has primarily been caused by stagnant investment since the 1997 financial crisis. Using the dynamic FCGE model, several counterfactual scenarios can be simulated to further characterize the excess saving condition. The results of these scenarios should indicate the magnitude and direction of the impact that excess saving trend can transmit on income inequality, poverty, and unemployment. The next section describes the first set of simulation and analysis.

1.4.1. Investment Shock

The first set of counterfactual simulation is to implement two opposite scenarios for worsening and improving excess saving trend within the inter-temporal framework. In each scenario, bank credit channeled to corporate sector’s investment (ss_{firm}) is adjusted, which will affect the price level via changes in aggregate demand. This is executed by a one-time shock in 2006 through the stock level of bank’s holding in risk-free asset ($AssetS_{asgb,bank}$). For example, an increased amount of government bond holding in the bank’s asset portfolio reduces the share of bank loan to the corporate sector, which leads to lower investment and worsening excess saving trend (Scenario 1). On the contrary, a decline in the government bond holding raises the loan share that stimulates higher investment and improved excess saving condition (Scenario 2).

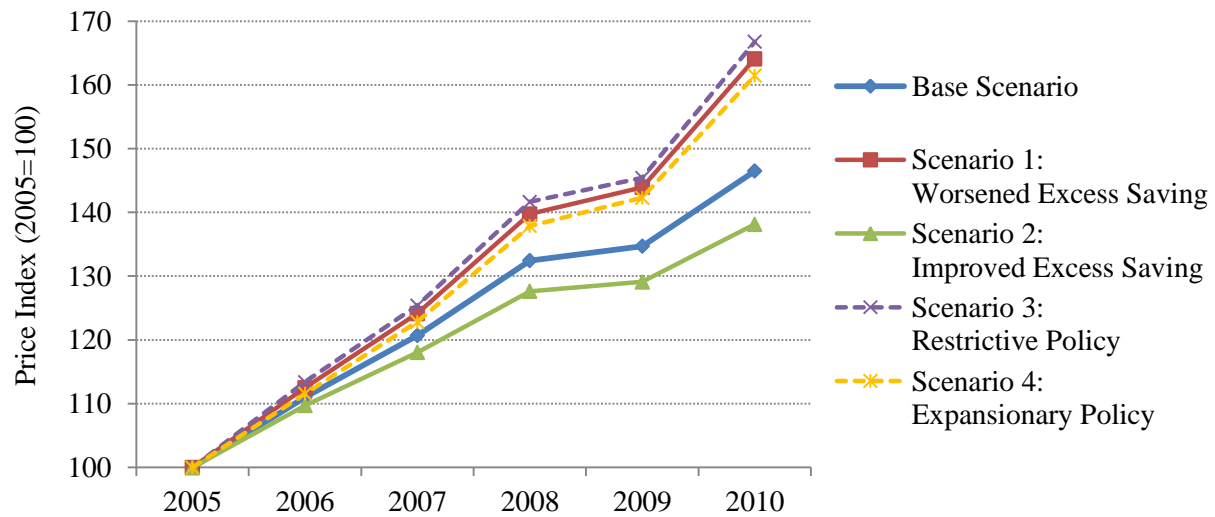
The results of the welfare impact from the two scenarios are displayed in Figure 1.8. Despite a small magnitude of deviations from the base scenario, the direction of impact on the welfare indicators are clear: Scenario 1 exerts higher income inequality for both poor-rich and rural-urban household categories while Scenario 2 produces lower income inequality. Worsening trend of excess saving can also lead to a steep increase in the price of poverty line (*PLTOT*), while an improving excess saving trend generates lower poverty line price. This result implies that larger number of poor households remain living under the subsistence level than it would have been with an improved condition, which can worsen the pace of poverty reduction across the population. Thus, although the results show no implication on the real condition of the poor and rural population—because the absolute income of the poor and rural households have actually increased—, the results indicate that the rich and urban households have benefitted more than their poor and rural counterparts from the excess saving trend.

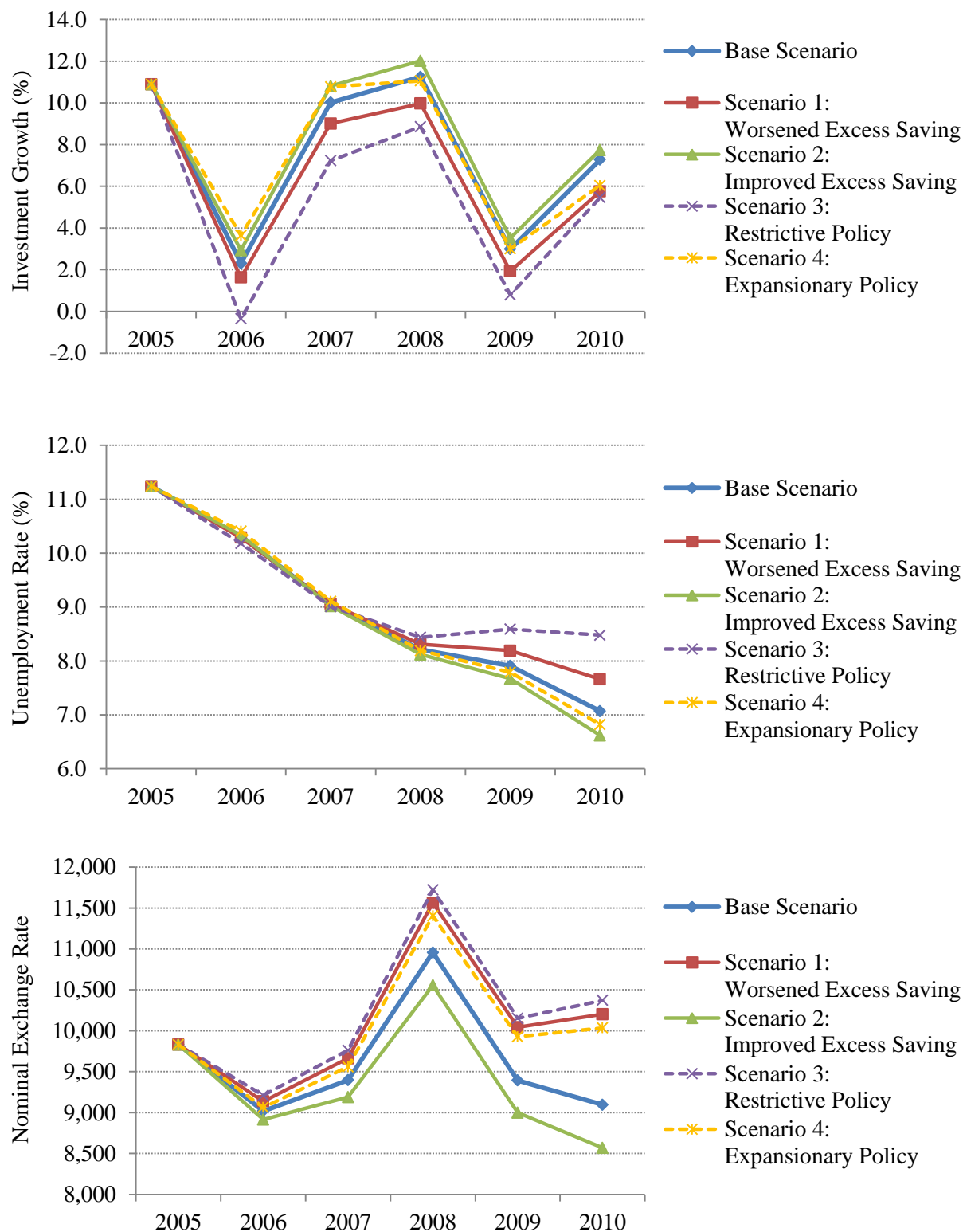
The impacts of Scenario 1 and 2 on macroeconomic performances can also be observed in Figure 1.9. Worsening trend of excess saving produces consistently lower rate of growth for real output and investment than that of improved condition. This decline in the investment rate affects domestic production, and the contraction of aggregate economic activities will eventually be transmitted to household income through lower wages and employment. The results are slower pace of unemployment drop and higher trends in price index and the nominal exchange rate. Accordingly, the simulation exercises in this section have revealed that limiting the safe asset composition of banks' financial portfolio will improve the excess saving trend and, ultimately, achieve both growth and equity objectives of the country.



Source: Results of model simulation.

Figure 1.8: Trends for Welfare Indicators under Different Scenarios





Source: Results of model simulation.

Figure 1.9: Trends for Macroeconomic Performances under Different Scenarios

1.4.2. Monetary Policy Shock

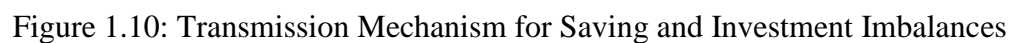
In this section, the role of monetary policy is analyzed through a set of counterfactual simulations that respond to Scenario 1 as a worse-case scenario. The first policy simulation is a restrictive monetary policy through an interest rate hike, as displayed in Scenario 3, whereas the second simulation is an expansionary monetary policy through a reduction in the interest rate, as depicted in Scenario 4. The results of these two scenarios should indicate the magnitude and direction of the impact that an interest rate policy can influence on the worse-case scenario of excess saving trend (see Figure 1.8 and 1.9).

In Scenario 3, the benchmark interest rate for SBI is set higher than the base run value through a one-time shock in 2006. The dynamic simulation results show that tight monetary policy produces higher income inequality for both poor-rich and rural-urban household categories than an improved condition. Higher interest rate leads to higher rate of return from the financial market which, in turn, results in higher interest payments and dividends for the capital owners. Thus, the relative income level of the urban rich household group improves more than that of the rural poor counterpart, which implies an apparent increase in the income disparity between the two household groups. In terms of poverty, monetary restriction produces unfavorable outcome in poverty reduction, as implied by the higher price of poverty line than that from the base scenario.

The repercussion of restrictive monetary policy on macroeconomic performances during worsening trend of excess saving does not look promising either. The results indicated much worse condition across all macro indicators than that if monetary restriction were not applied.

On the contrary, Scenario 4 generates better outcome across all indicators than those produced by Scenario 3, as revealed in Figure 1.8 and 1.9. The results also indicate no trade-off

Finally, Figure 1.10 summarizes the simplified linkage between excess saving and income of the household institution in the presence of financial market.



Through an investment shock in the real sector, capital tends to move from fixed assets to financial assets, which can eventually drive up the value of the assets. Rising asset value in turn generates positive wealth change and higher income transfer to institutions holding those assets, particularly the corporate sector and investors. Thus, what is crucial in the analysis of this section is the substitution of fixed assets for financial assets in the portfolio of the institutions. In this context, the important transmission mechanism is the imperfect substitution between fixed assets and financial claims. Substitutions among various types of financial instruments in the portfolio are relatively less important. Their main function is to enhance the efficiency of financial markets by developing various alternative financial assets and liabilities with differing characteristics to meet various preferences of each institution.

1.5. Sensitivity Analysis

In this section, the robustness of the simulation results is tested in response to some parameter changes. A set of key parameters most relevant to the counterfactual simulations described in the previous section are the bank loan share parameter of the investment function ($\lambda 2_i$) in Eq. 58 and the price elasticity of the wage determination (vp_i) in Eq. 34. The stability of each of these two parameters is examined for 2006.

Table 1.2 shows that higher values of $\lambda 2_i$ in the investment equation lead to higher real GDP and price index, and vice versa. These results confirm that more credit to the corporate sector allows more investment to be realized, which increases domestic production and, in turn, labor wages across the board.

Table 1.2: Sensitivity on Loan Ratio Share Parameter in Investment Function

$\lambda 2_i$	$RGDP$	$PINDEX$	INC_{ph}	INC_{ruh}	$PLTOT$	$UEMPR$
2.00	5.55	142.30	100,496	1,217,435	1.0756	10.00
1.50	5.53	135.25	96,231	1,152,251	1.0221	10.06
1.00	5.46	110.97	81,548	927,944	0.8380	10.31
0.50	5.26	77.33	61,180	616,695	0.5829	10.95
0.01	4.91	54.55	47,378	405,827	0.4102	11.88

Note: $RGDP$ is real GDP growth rate (%). $PINDEX$ is price index (%). INC_{ph} is income of poor household (billions of rupiah). INC_{ruh} is income of rural household (billions of rupiah). $PLTOT$ is price of poverty line for total population. $UEMPR$ is unemployment rate (%).

Source: Results of model simulation.

Likewise, the price elasticity of wages can play a critical role in determining the effect of the monetary policy shock that causes change in prices on wage income. In particular, an expansionary policy (e.g., a negative interest rate shock) can affect the wage of the specific household group differently when the price elasticity is altered. The result implies that the value of vp_i can determine the resulting income inequality and poverty line.

Table 1.3 shows the opposite direction of the previous table except the price index and the price of poverty line. In particular, higher values of vp_i in wage determination leads to lower GDP and a modest increase in the price index. The resulting lower production activities will then lead to lower demand for input, lower wage, and lower income across all household groups. Consequently, poverty reduction is hindered since the lower income of poor and rural household cannot keep up with inflation (i.e., higher price of poverty line). The results are widening income inequality and rising unemployment level in the economy.

Table 1.3: Sensitivity on Price Elasticity of Wage Function

vp_i	$RGDP$	$PINDEX$	INC_{ph}	INC_{ruh}	$PLTOT$	$UEMPR$
1.70	4.68	111.22	81,163	921,324	0.8402	11.67
1.40	5.00	111.13	81,328	923,165	0.8394	11.11
1.00	5.46	110.97	81,548	927,944	0.8380	10.31
0.50	6.10	110.83	81,886	933,590	0.8366	9.21
0.01	6.79	110.62	82,222	939,373	0.8348	8.00

Note: $RGDP$ is real GDP growth rate (%). $PINDEX$ is price index (%). INC_{ph} is income of poor household (billions of rupiah). INC_{ruh} is income of rural household (billions of rupiah). $PLTOT$ is price of poverty line for total population. $UEMPR$ is unemployment rate (%).

Source: Results of model simulation.

1.6. Conclusion

This chapter has shown that domestic private investment plays a crucial role on the income of household institution, while banks accumulating risk-free assets in their financial portfolio can result in widening income inequality, slower pace of poverty reduction, and higher unemployment in the economy. The FCGE simulation in this chapter also demonstrates that expansionary monetary policy can reduce the negative impact of excess saving trend in the economy. The impact of the excess saving on welfare is expected to vary among the developing countries, depending on their market structure and financial market contribution to the real sector. Hence, a new saving scheme in the backdrop of loose monetary policy should also be introduced to mobilize domestic savings in the economy.

Furthermore, most academicians and policy makers believe that the predominant means of development is economic growth, and that growth of the domestic capital market is the

product of an increase in the national saving. However, as has been indicated by the results of this chapter, growth generated from the excess saving trend has not transformed into equity improvement, significant poverty reduction, and high employment creation. From a global perspective, financial development is a particularly attractive trend, as it would help permit capital inflow to find the highest-return uses and, by easing borrowing constraints, to spur domestic consumption. However, growth in financial market plays an apparent role in shaping the path of economic well-being in a developing country. The distribution and poverty impact of financial assets characterized by lackluster investment in productive sectors can lead to adverse impact in the welfare of the population. Hence, developing economies need to balance growth in both real sector and the financial market without relying much upon the private market incentives to achieve an efficient allocation of resources.

Finally, to extend the analysis of this chapter, one can further explore the distribution impact of the excess saving trend on a detailed level of the population. To do so, one must link the FCGE model with micro-simulation of household surveys. In addition, while macroeconomists find it convenient to characterize economic behavior using a single ‘representative’ agent’s microeconomic problems, it is only too easy to point out that relationships among aggregate variables are much more complex when individuals’ objectives and/or economic circumstances are heterogenous, particularly in the case where income distribution is an issue.

REFERENCES

- Armington, Paul. 1969. "A Theory of Demand for Products Distinguished by Place and Production." *IMF Staff Papers* 16 (1): 1268-1290.
- Azis, Iwan. 2002. "What Would Have Happened in Indonesia if Different Economic Policies had been Implemented When the Crisis Started?" *The Asian Economic Papers* 1 (2): 76-103.
- _____. 2008. "Macroeconomic Policy and Poverty." Asian Development Bank Institute Working Paper 111, Tokyo.
- _____. 2009. "Macro Stability Can Be Detrimental to Poverty." *Economics and Finance in Indonesia* 57 (1): 1-23.
- Azis, Iwan, and Mario Lamberte. 2010. "ASEAN Imbalances and Rebalancing." Unpublished manuscript, Asian Development Bank Institute, Tokyo.
- Bourguignon, François, William Branson, and Jaime de Melo. 1989. "Adjustment and Income Distribution: A Counterfactual Analysis." Working Paper 215, World Bank, Washington, DC.
- Central Bureau of Statistics and Bank Indonesia. 2008. *Financial Social Accounting Matrix Indonesia 2005*, Jakarta: Bank Indonesia.
- Chinn, Menzie, and Hiro Ito. 2006. "What Matters for Financial Development? Capital Controls, Institutions, and Interactions." *Journal of Development Economics* 81 (1): 163-192.

- Claessens, Stijn, Simeon Djankov, and Larry Lang. 1999. "Corporate Diversification in East Asia: The Role of Ultimate Ownership Structure and Group Affiliation." Policy Research Working Paper 2089, World Bank, Washington, DC.
- Dervis, Kemal, Jaime de Melo, and Sherman Robinson. 1982. *General Equilibrium Models for Developing Policy*. Cambridge: Cambridge University Press.
- Galor, Oded, and Joseph Zeira. 1993. "Income Distribution and Macroeconomics." *Review of Economic Studies* 60 (1): 35-52.
- Goldberg, Pinelopi, and Nina Pavcnik. 2007. "Distributional Effects of Globalization in Developing Countries." *Journal of Economic Literature* 45 (1): 39-82.
- Greenwood, Jeremy, and Boyan Jovanovic. 1990. "Financial Development, Growth, and the Distribution of Income." *Journal of Political Economy* 98 (5): 1076-1107.
- Keuning, Steven. 1991. "Allocation and Composition of Fixed Capital Stock in Indonesia: An Indirect Estimate Using Incremental Capital Value Added Ratios." *Bulletin of Indonesian Economic Studies* 27 (2): 91-119.
- Krugman, Paul. 1999. "Balance Sheets, the Transfer Problem, and Financial Crises." *International Tax and Public Finance* 6 (4): 459-472.
- Stiglitz, Joseph, and Bruce Greenwald. 2003. *Towards a New Paradigm in Monetary Economics*. Cambridge: Cambridge University Press.

Thorbecke, Erik, et al. 1992. *Adjustment and Equity in Indonesia*. Development Centre Studies, Organisation for Economic Co-operation and Development (OECD), Paris.

Tobin, James. 1970. "A General Equilibrium Approach to Monetary Theory." *Journal of Money, Credit and Banking* 2 (November): 461-472.

Van der Eng, Pierre. 2008. "Capital Formation and Capital Stock in Indonesia, 1950-2007." Working Paper 24, The Australian National University.

CHAPTER 2

REBALANCING FOR SUSTAINABLE AND INCLUSIVE GROWTH:

CASE OF INDONESIA

2.1. Introduction

The problem of excess saving trend in East Asia is very important not only to the region's own interest in equitable development and employment creation, but also its contribution to global imbalances. It is apparent that the region has been a major contributor to the growing size of global trade imbalances in the last decade. A prominent feature of these imbalances is a large, widening account deficit in the US, representing roughly two-thirds of the global current account deficits, and growing surpluses in the East Asia emerging economies, generating almost half of the global surpluses.⁸ While these imbalances have narrowed considerably since the global financial crisis of 2007-2008, there remains an urgent need for the East Asia countries to restructure their external balance and saving-investment gap. Failure to do so could result in the world economy being stuck 'midstream', threatening the sustainability of the world economic recovery from the recent great recession (Blanchard and Milesi-Ferretti, 2009).

To illustrate the policy option for growth strategies in a developing market economy, Indonesia will be selected as a case study.⁹ Among other economies in the East Asia region, Indonesia has been the most deeply affected country by the East Asia financial crisis in 1997 (see Table 2.1). Although growth has been modest since the crisis, the current pace is much lower

⁸ See Azis (2007) for further exposition on the issue of global imbalances.

⁹ Note that different countries require different growth strategies since they have different economic structure, degree of market openness, and trade dynamics, among other attributes.

than what was achieved before the 1997 crisis. Real GDP growth rate has never exceeded the average level of 7.9 percent achieved between 1990 and 1996 (i.e., during the years of the ‘East Asian miracle’). In addition, employment growth has barely been keeping up with growth in the labor force. If real GDP trend were to be maintained at the prevailing trajectory, Indonesia would require about 23 years in reaching the per capita income level that Thailand had achieved in 2008. In the development front, the pace of poverty reduction has also slowed in the last decade and the poverty incidence, at 14.1 percent in 2009, is only 3.4 percentage points lower than that in 1996. Meanwhile, spatial inequality across the archipelagic provinces and the urban-rural divide have widened since the 1997 crisis.

Table 2.1: Macroeconomic and Development Indicators in Indonesia, 1990-2011 (in percent)

	1990-96	1997	1998	1999	2000	2002	2005	2007	2009	2011
GDP growth rate	7.9	4.7	-13.1	0.8	5.4	4.5	5.7	6.3	4.5	6.5
Unemployment rate	4.0	4.7	5.5	6.4	6.1	9.1	11.2	9.1	7.9	6.6
Inflation rate	8.5	6.2	58.0	20.7	3.8	11.8	17.1	6.6	2.8	3.8
Poverty	17.5	-	24.2	23.4	19.1	18.2	16.0	16.6	14.1	12.5
Gini index	0.35	-	-	0.31	-	0.32	0.34	0.37	-	0.38

Note: Poverty is ratio of poor in population living under poverty line. Gini index: value ranges from zero (perfect equality) to one (perfect inequality).

Source: Central Bureau of Statistics, Indonesia.

Why has Indonesia struggled to achieve faster pace of economic growth, substantial poverty reduction, and a more balanced distribution of income? What are the policy options for Indonesia to achieve sustainable and inclusive growth?

This chapter attempts to answer the questions by identifying new growth strategies that Indonesia can undertake in the aftermath of the 2007-2008 global financial crisis. With the use of financial computable general equilibrium (FCGE) model constructed in the previous chapter, counterfactual simulations can be experimented to offer some policy recommendations in rebalancing the economy toward a new growth trajectory with inclusivity. It has been shown that the excess saving trend in Indonesia has ripple effects on employment, income distribution, and poverty. Therefore, growth strategies that can particularly improve the saving and investment gap and restructure the external balance will be analyzed in great details in this chapter.

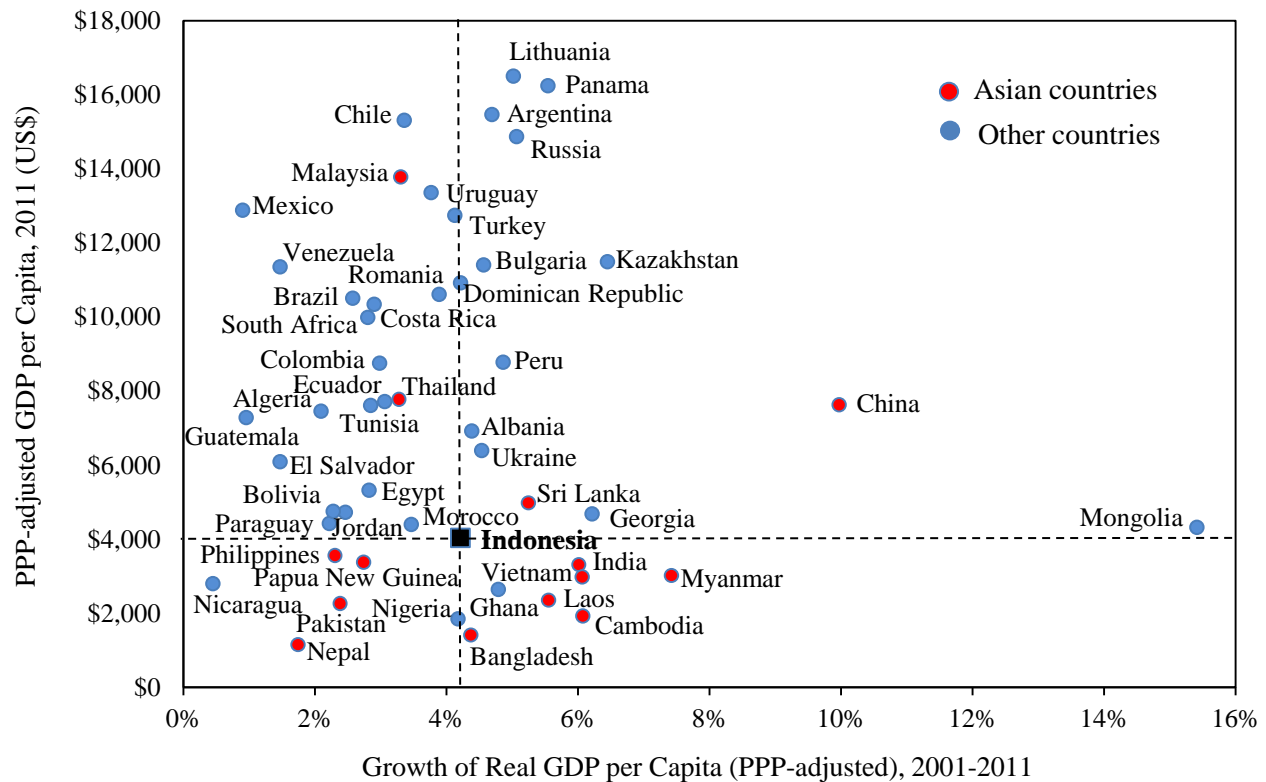
The following section summarizes an overview of Indonesia's macroeconomic performances among other middle income countries (MICs).¹⁰ Growth strategies for the country's saving and investment imbalance as well as trade balance are then discussed in Section 2.3. Section 2.4 follows with some counterfactual simulations. Section 1.5 uses sensitivity analysis to check the robustness of the model results. Section 1.6 concludes the chapter.

2.2. Macroeconomic Overview

In 2011, Indonesia produced a nominal gross domestic product (GDP) of US\$830 billion, which elevated its GDP per capital (in PPP) to a new historical level of US\$4,000. The impact of the global financial crisis 2007-2008 has been comparably modest; however, Indonesia's growth

¹⁰ For illustrative purpose, the figures that show Indonesia's performances among other MICs in this chapter will include several low income countries in East Asia, such as Bangladesh, Cambodia, Myanmar, and Nepal.

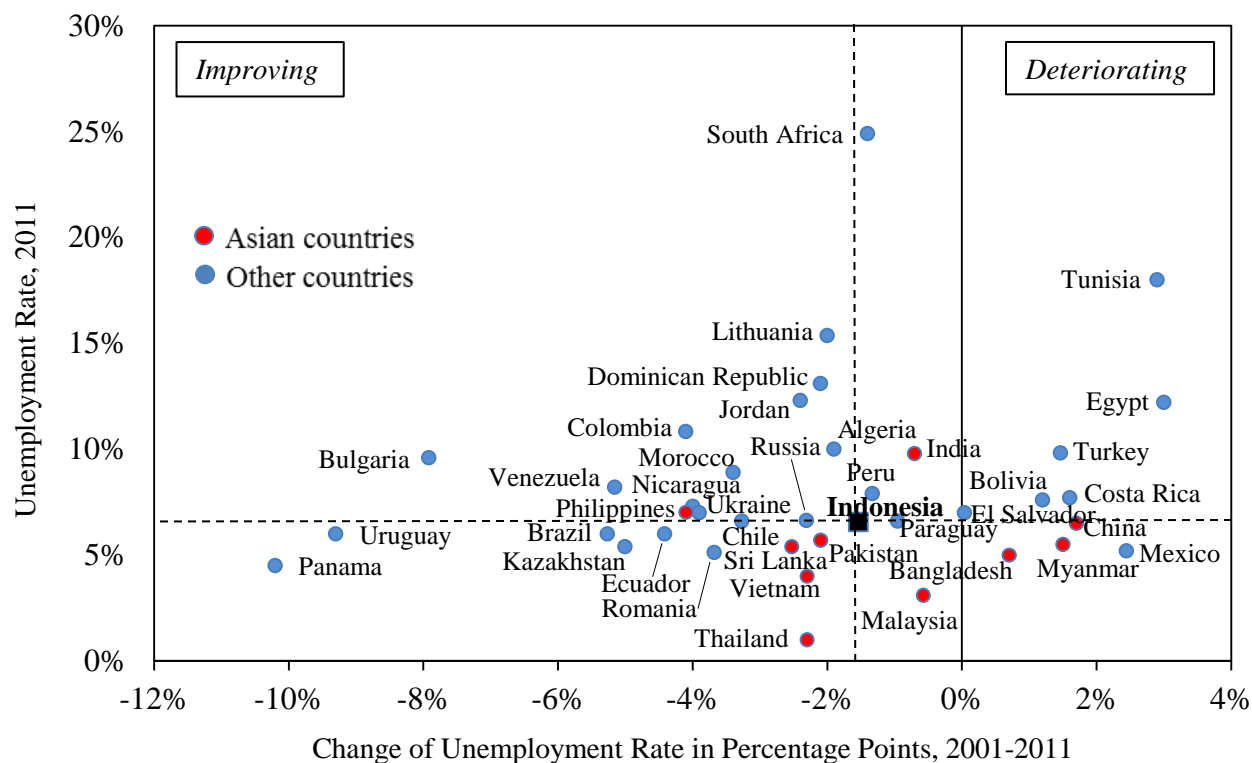
remains stagnant, and growth rates have only been average relative to other MICs (see Figure 2.1).



Source: Economic Intelligence Unit (2012), author's calculation.

Figure 2.1: Growth Performance of Indonesia among Middle Income Countries

Furthermore, despite an improving trend in the unemployment rate over the last decade, Indonesia's performance in this category has also been average relative to other MICs (see Figure 2.2). The rate of open unemployment has gradually decreased from the relatively high 11.2 percent in 2005 to 6.6 percent in 2011, but the economic efficacy to generate higher pace of employment growth is still lacking in order to reduce the unemployment rate down below the majority of the Asian MICs.

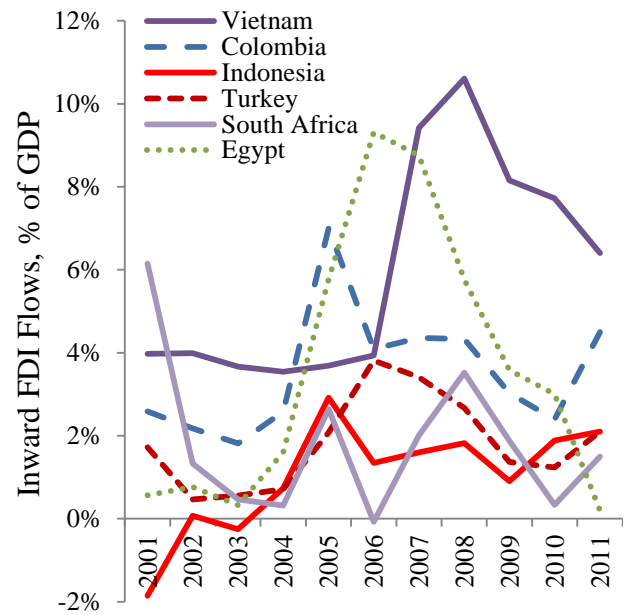
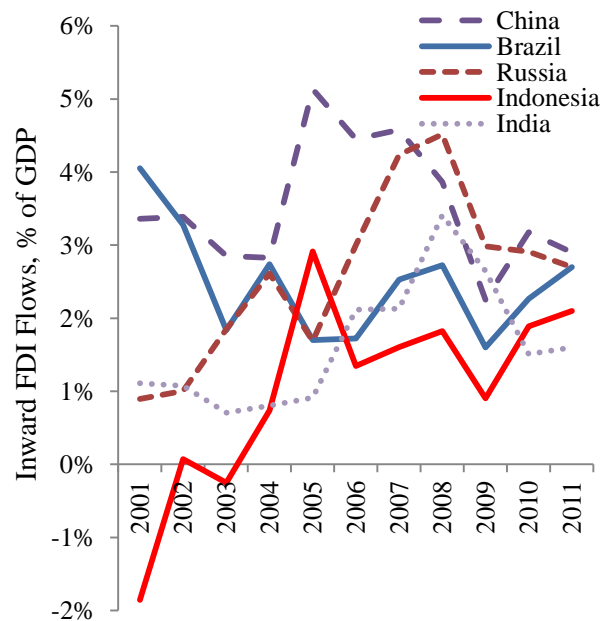
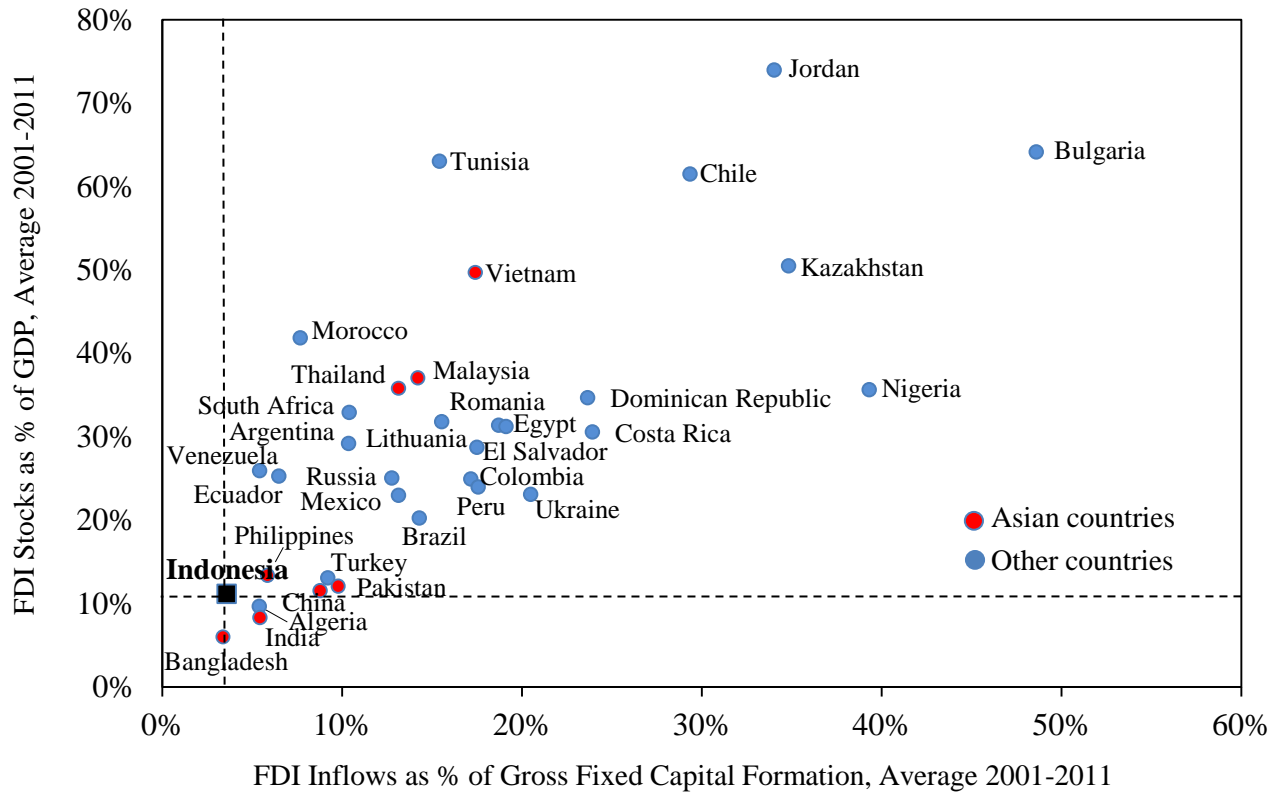


Source: Economic Intelligence Unit (2012).

Figure 2.2: Unemployment Performance of Indonesia among Middle Income Countries

Furthermore, inward foreign direct investment has remained a small portion of the total investment between 2001 and 2011. When compared with other MICs, ‘BRIC’ and ‘CIVETS’ emerging countries, Indonesia is still lagging behind (see Figure 2.3).¹¹ Therefore, the country’s reliance on domestic investment by the private and public sector is still much needed to offset the small share of foreign investment in the real sector.

¹¹ The acronym ‘BRIC’ is first coined by Jim O’Neill (2001), a Goldman Sachs economist, to represent the large, fast-growing economies that consist of Brazil, Russia, India, and China. Meanwhile, the acronym ‘CIVETS’ is coined in 2009 by Robert Ward, Economist Intelligence Unit director, to represent the current dynamic emerging economies with a young, growing population that consist of Columbia, Indonesia, Vietnam, Egypt, Turkey, and South Africa.



Source: Economic Intelligence Unit (2012).

Figure 2.3: Inward Foreign Investment of Indonesia among MICs, BRIC, and CIVETS

Finally, it is worth noting that the growth drivers for Indonesia's economy have changed since the 1997 crisis. In fact, the slower output growth in the past decade has not been uniform across sectors (see Table 2.2). Comparing the periods 1990-1996 and 2000-2008, two sectors have grown faster, agriculture and transportation, whereas a major slowdown exists in three sectors, mining and utilities, manufacturing, and construction.

Table 2.2: Sector Output and Employment Growth in Indonesia, 1990-2008

	1990-1996	2000-2008
<hr/>		
GDP growth (%)		
Agriculture	3.1	3.9
Mining and utilities	5.3	1.5
Manufacturing	11.2	5.2
Construction	13.7	6.5
Wholesale trade	8.9	5.8
Transportation	8.2	10.1
Others	6.4	5.8
Total	7.9	5.3
Employment growth (%)		
Agriculture	-1.7	0.2
Mining and utilities	6.0	3.7
Manufacturing	6.0	0.9
Construction	10.8	5.7
Wholesale trade	6.5	1.7
Transportation	9.4	3.9
Others	4.6	3.6
Total	2.3	1.7

Source: Central Bureau of Statistics, Indonesia.

2.3. Rebalancing Strategies

The following seven sections discuss the growth strategies that Indonesia can follow to rebalance its economy toward achieving sustainable and inclusive growth. Rapid pace of growth is unquestionably necessary for high employment creation and substantial poverty reduction, but for this growth to be sustainable in the long run, it should also be broad based across sectors and inclusive of the large part of the economy's labor force.

2.3.1. Increasing Domestic Investment in Real Sector

Accelerating private investment in the real sector is crucial to achieving sustainable and inclusive growth. Azis and Lamberte (2010) showed that the main reason for the significant reversal of the saving and investment imbalances in the aftermath of the financial crisis in 1997 is due to the low ratio of investment to GDP. Both private and public sector investment ratios have declined substantially from the pre-1997 crisis period. While the investment ratio prior to the 1997 crisis was too high, given the economic bubble at the time, the prevailing trend is certainly too low, particularly if combined with the relatively high saving rate in the country. Therefore, an important strategy to rebalance growth is to focus on increasing private investment in productive sectors such as agriculture and manufacturing, which have lagged behind other sectors in generating high employment level, as well as employment-enhancing service sectors, such as transportation and telecommunications.

Nevertheless, it is unlikely that the private sector can be the driver of a new investment spurt given Indonesia's lackluster investment climate. Hence, government spending will need to assume the leading role in pump-priming growth in the economy. The role of public sector to

lead an investment push becomes more prominent if a more spatially equitable allocation of infrastructure and services across the country is desired. Weak infrastructure has limited the country's inter-provincial trade and specialization, which in turn has made it difficult to access the national market. Historically, regional demand for investment is highest in Java and Bali since domestic economic activities are centralized in these two main islands where more than 40 percent of the country's population reside. Therefore, increasing public expenditure on infrastructure development outside the two islands should induce regional economic development and, eventually, faster pace of output growth at the national level. Some questions, however, will remain as to how much public infrastructure spending should be made to create a significant impact on the domestic investment climate, and how much fiscal space does the central government have to accommodate higher public investment.

2.3.2. Increasing Investment Contribution to Growth and Spatial Equity

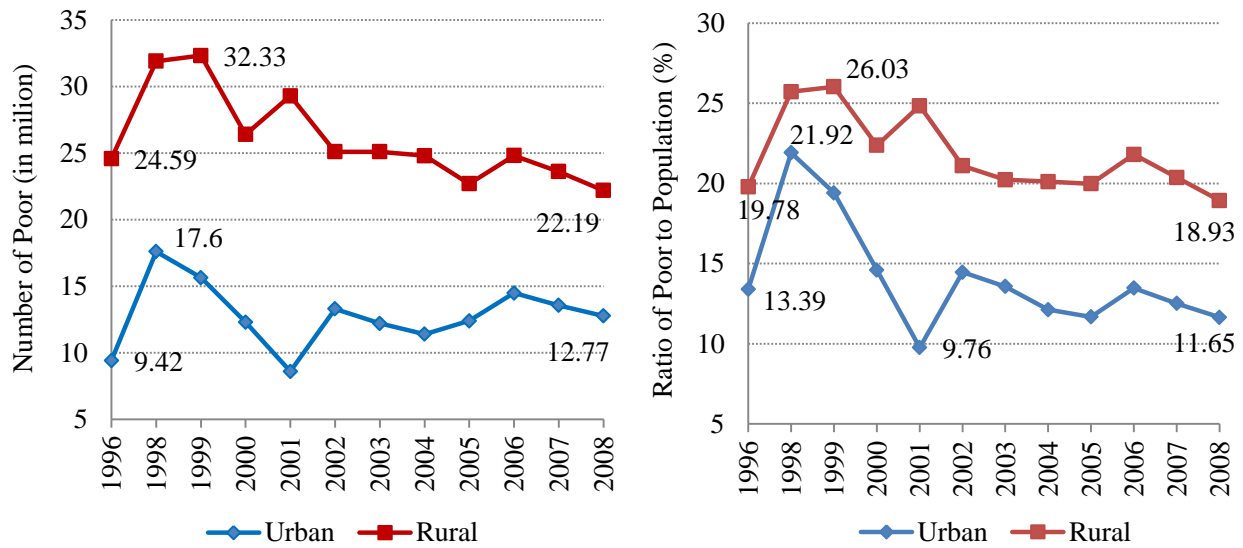
As discussed in the previous section, increasing investment share of contribution to output is a task for both public and private sector. For the private sector, the biggest challenge is to allocate its investment in productive sectors to generate higher employment growth. In particular, large decline in the employment elasticity of the manufacturing sector relative to other sectors since the 1997 crisis makes it imperative to increase the efficacy of this particular sector to rebalance growth.

Nevertheless, increasing a substantial amount of domestic investment in manufacturing may not be efficient in some ways, which may contribute to the concentration of capital investment in the urban area and, eventually, unequal distribution of income in the rural-urban divide. In fact, the income share of urban workers in the country is already at 63 percent, far

greater than that of their rural counterparts at 37 percent. Therefore, investment policy that can transmit greater economic activities in the rural areas will most likely improve the rural-urban disparity. For instance, a two-pronged approach to promote investment in manufacturing and agriculture should not only contribute to more manufacturing jobs in the economy, but also raise the employment elasticity of the agricultural sector, which has been the lowest among all sectors since the 1997 crisis.

Furthermore, spatial inequality between the geographically advantaged and disadvantaged provinces have also dramatically increased partly as a consequence of the uneven impact of investment and economic activities. While there are efficiency gains from the concentration of economic activities in urban centers and coastal regions, the associated spatial inequality in Indonesia has certainly been a major contributor to the gradual rise of the country's Gini index since the 1997 crisis.

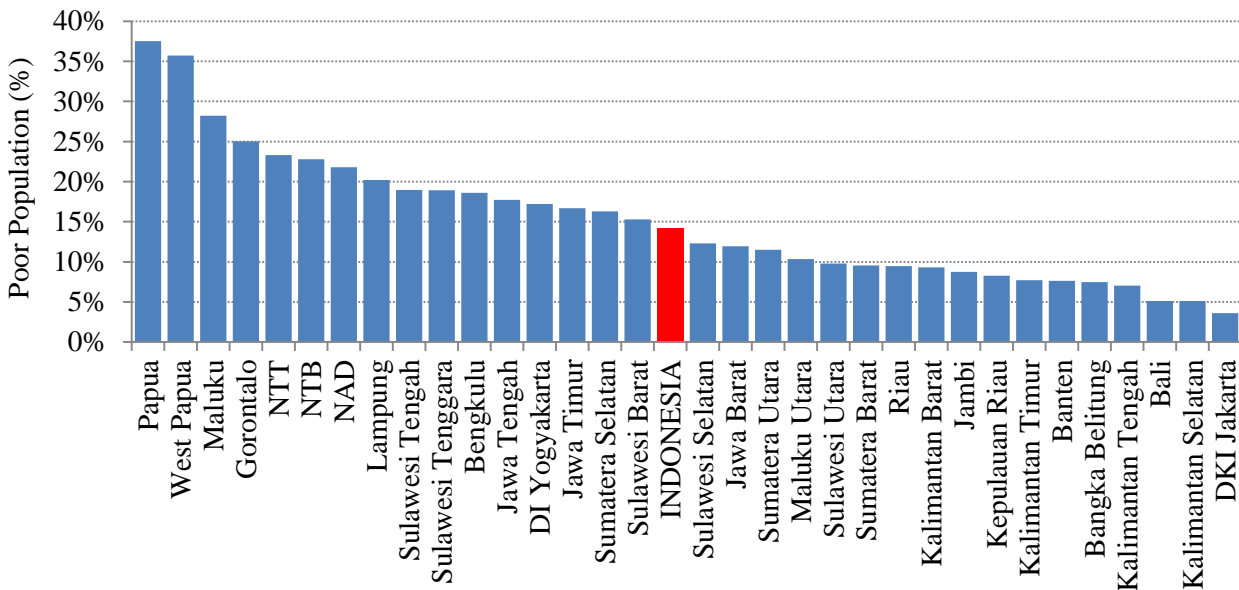
In term of poverty, the poverty incidence in the country's rural areas is far more prevalent than in the urban areas. Roughly 18.9 percent of rural households are living below the poverty line in 2009 compared to 11.6 percent of their urban counterparts (see Figure 2.4). Hence, policy that supports agricultural development and promotes rural-urban linkages has the potential to improve the rural poverty. Infrastructures such as road, transportation, and telecommunications are crucial in achieving better rural-urban linkages as it facilitates mobility and, eventually, access to markets, employment, and services for the rural population. Public investment in education and health is also crucial for the small rural farms to establish their own business and access non-farm jobs in the rural non-farm sector. The rural non-farm sector is important for the growth of the rural economy as well as for rural-urban income distribution. It also provides opportunities for livelihood diversification for poor rural households.



Source: Central Bureau of Statistics, Indonesia.

Figure 2.4: Rural-Urban Poverty in Indonesia, 1996-2009

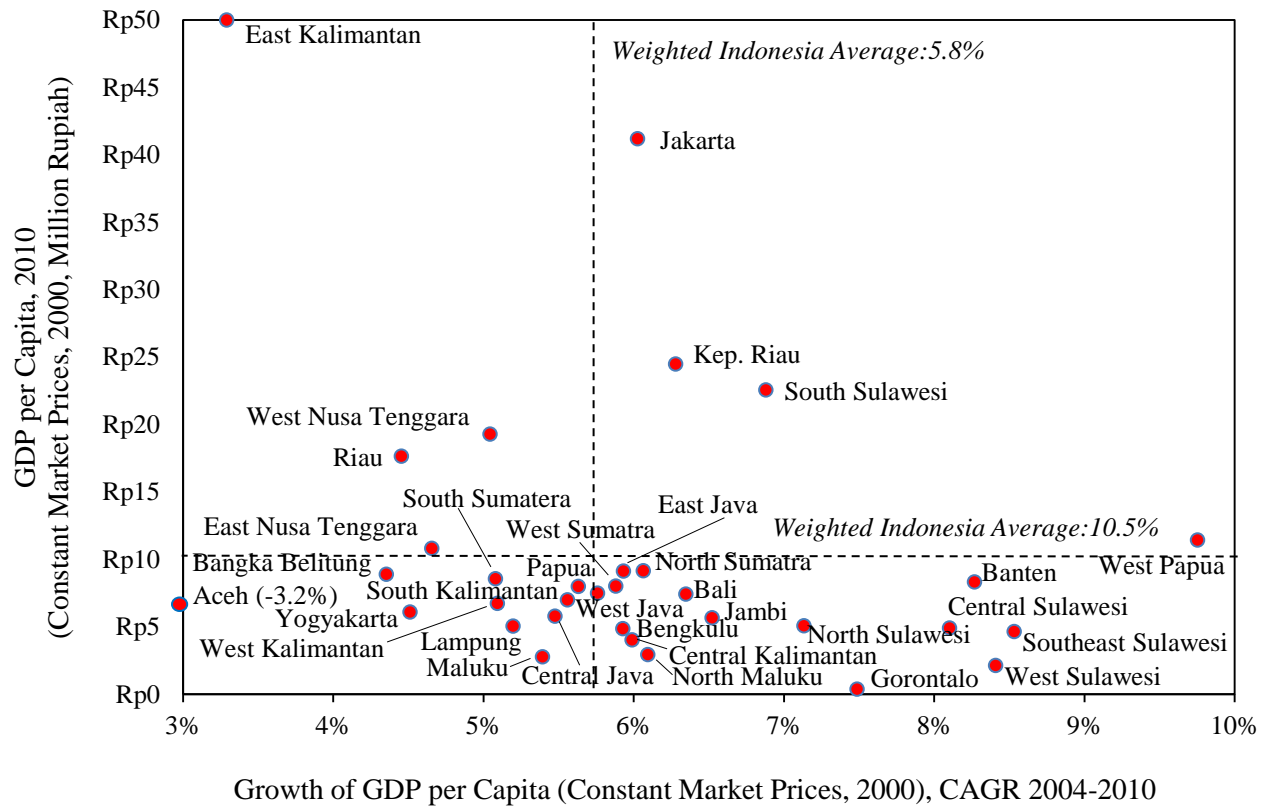
Increasing investment contribution to the rural areas can also benefit urban areas in many ways. For example, the development of rural industrial sectors can contribute to the growth of urban industries, and vice versa. Growth in the rural economy also generates fiscal and financial outflows from rural to urban areas (e.g., tax from rural-based industries). Hence, any strategy to rebalance growth must include more investment in the less developed region of the country. The rural-urban linkages are particularly weak in the provinces where rural non-farm employment, development of rural small towns, and rural-urban migration lag behind the more developed provinces. Therefore, the impact of higher investment on rural poverty reduction will be most affected in the poorest provinces of Papua, West Papua, and Maluku (see Figure 2.5).



Source: Central Bureau of Statistics, Indonesia.

Figure 2.5: Proportion of Poor by Provinces, 2009

Finally, Indonesia has typically followed development strategies favoring the urban sector. This urban bias still prevails in terms of the central government's investment priorities that disproportionately favor urban areas across the country. To some extent, this condition impedes the efficient allocation of factors, therefore contributing to the unequal development between the rural and urban areas. Hence, correcting this imbalance will not only contribute to higher rural growth, but also secure future urban growth (Fan and Chan-Kang, 2005). More importantly, correcting the urban bias will lead to larger reductions in poverty as well as more balanced growth path across provinces in the country (see Figure 2.6 for variation in Indonesia's regional output).



Source: Central Bureau of Statistics, Indonesia.

Figure 2.6: Regional Growth Performance by Provinces

2.3.3. Promoting Good Governance on Public Investment

Given the burden on the government's limited fiscal space, particularly due to the long-standing policy on domestic fuel and electricity subsidies, a social accountability is needed for public investment to make sure that investment project is carried out effectively. For instance, it is important to put in place an effective system of project scrutiny and evaluations to make sure that public projects are financially viable and yield adequate economic return. In fact, Indonesia should learn important lessons from the New Order regime (i.e., under the rule of late President Soeharto) when, due to loopholes in the legal framework, well-connected politicians and

business people were able to push through mega projects with negligible evaluations. Most of the mega projects (e.g., national car project, state-owned aircraft company, etc.) approved and built at that time ended up in severe financial difficulties, and many had to be bailed out by the government. The lesson from these experiences should be that if Indonesia were to move into another phase of infrastructure investment push, whether to be carried out by the government, or initiated by the public sector but to be carried out by the private sector, an effective system of scrutiny, project evaluations, and cross-checking should be put in place before embarking on such a phase.

2.3.4. Developing Domestic Capital Goods Industries

Although the import share of investment in the real sector has decreased considerably since the 1997 financial crisis, the development of more capital goods industries in Indonesia is desirable to reduce domestic reliance on imports and promote self-sufficient economy (see Table 2.3). For example, expanding the heavy equipment parts and components industry in the country can lead to less dependence of the mining and construction sectors on imported products, as well as create additional employment in the manufacturing sector. Hence, this policy becomes more important if private investment were to play a much larger role in promoting higher employment elasticity in the productive sectors, as discussed in the earlier section. Finally, the building of new factories, machinery, tools, and equipment to develop domestic capital goods industries will lead to more forward linkages among other industries, which results in higher output multiplier.

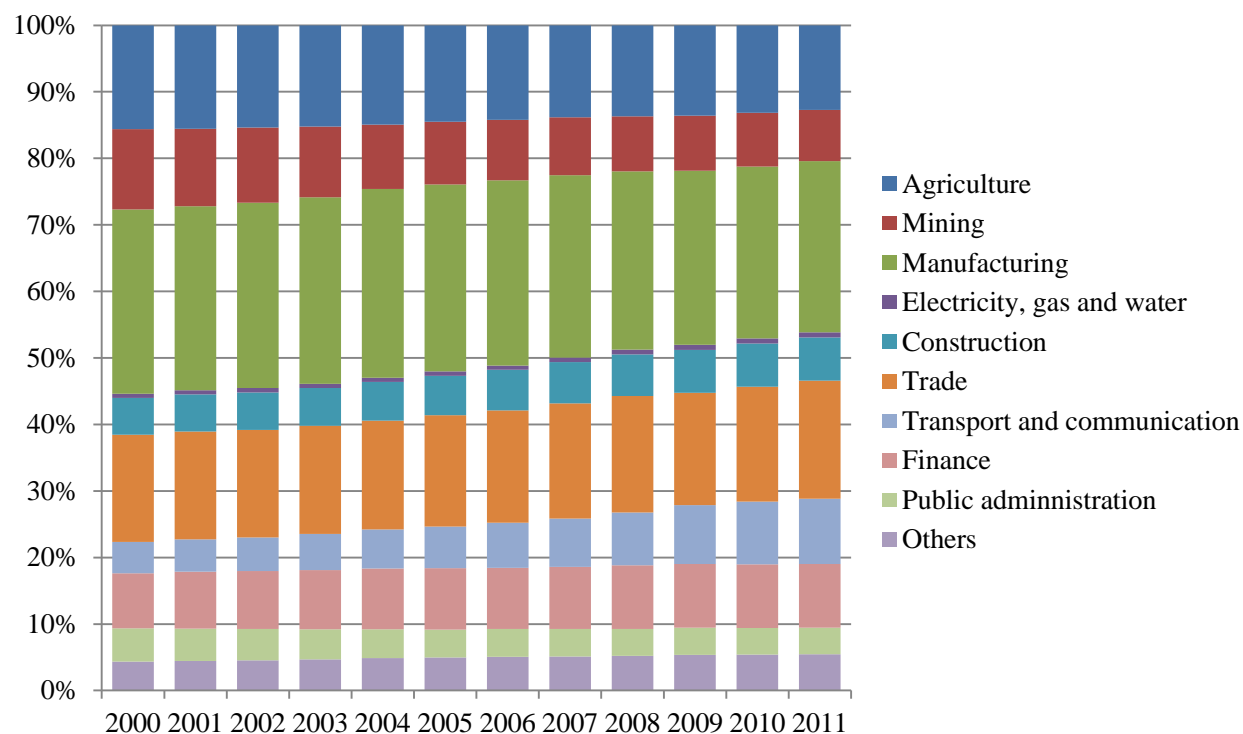
Table 2.3: Share of Imports in Investment

	Import Share (%)
1990	30.9
1993	32.4
1995	27.7
1998	31.9
2000	17.0
2005	14.0

Source: Indonesia's Social Accounting Matrix (SAM) tables for various years, author's calculation.

2.3.5. Increasing Economic Efficiency

Since economic efficiency is fostered by a competitive environment, it is important that various sectors of the economy be promptly exposed to competitive forces in the market. Indonesia's economic achievement prior to the financial crisis in 1997 is often described by impressive manufacturing sector and that it has always contributed to a larger share of the country's GDP than other sectors. Nevertheless, the service sector in transportation and telecommunications has picked up the slack as manufacturing showed lackluster performance in the aftermath of the crisis (see Figure 2.7). Hence, to boost services productivity, the government needs to expose the sector to greater competition. State monopolies in the sector need to be reviewed and so do regulatory rules that favor large incumbents or limit entry of new players in the market. Foreign investment law will certainly need to be revised to allow foreign investment into service sectors where competition and technology are lacking.



Source: Central Bureau of Statistics, Indonesia.

Figure 2.7: Sector Contribution to GDP, 2000-2011

In addition to opening up the service sector and privatizing inefficient state owned enterprises (SOEs), Indonesia needs to properly implement its domestic competition law concerning the prohibition of monopolistic practices and unfair business competition, which has been promulgated in 1999. If the law were to be implemented properly, large firms would be prevented from exploiting their market power in order to entrench their market dominance at the expense of smaller and perhaps more innovative firms.

To conclude, significant efficiency gains can be achieved from exposing the non-tradable sectors to greater competition by opening up the services market to foreign players and by circumscribing the role of state monopolies in the provision of many basic services (e.g., the

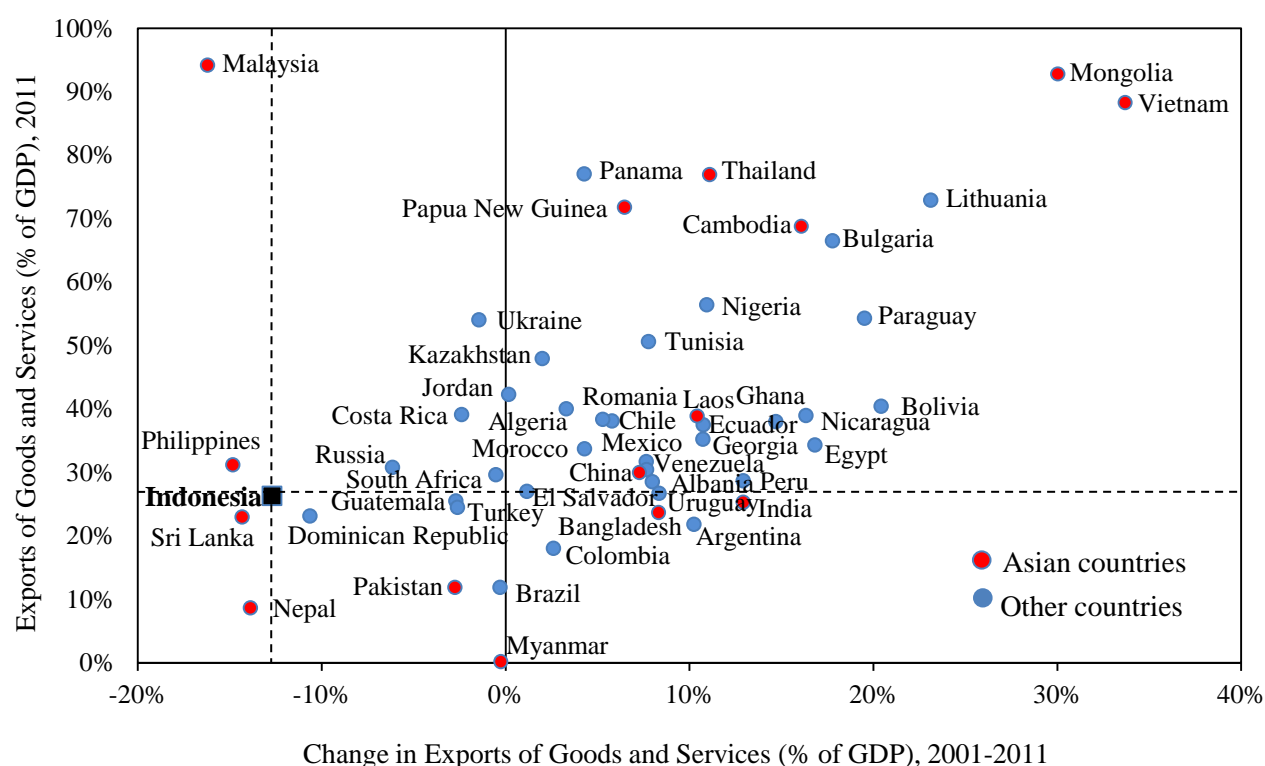
supply of electricity, water, etc.). Enforcement of the domestic competition law will help to ensure that competition will be fair for all firms in the economy.

2.3.6. Sharpening the Comparative Advantage and Improving Productivity

In an integrated global economy, specialization in trade is an increasingly prominent strategy. Indonesia, a labor-abundant economy, has used this feature to build large export-oriented sectors in low skilled, labor intensive activities such as garment and footwear manufacturing. However, the country has faced new stiff competition in the market for these products, especially from emerging low-wage producers such as Bangladesh, Sri Lanka and Vietnam. Therefore, facing sharp competition in international markets, Indonesia can no longer continue to rely on its traditional sources of comparative advantage, including its large supplies of relatively cheap, but mostly low-skilled labor. Hence, a more sustainable source of comparative advantage is required to raise the international competitiveness of the domestic manufacturing industries and reinvigorate the country's flagging export ratio compare to other Asian MICs (see Figure 2.8). With Indonesia facing a possible long-run downturn in growth, based on diminished prospects for labor intensive manufacturing exports, sharpening the comparative advantage in the employment-enhancing service sectors, such as transportation and telecommunications, becomes very important for sustaining growth.

Furthermore, there is clearly a great benefit to increase total factor productivity (TFP) for a more balanced growth path. If an economy could create more output from the same inputs, then growth would be enhanced and could replace growth that were previously generated by other factors, such as exports. In fact, there appears to be room to increase TFP in Indonesia. Past TFP studies have shown that manufacturing and service sectors tend to have negative TFP, and this

reflects many observations that the private sector invests relatively little in research and development, and that local firms simply buy technology from overseas to operate mostly as assembly type operation. If these firms were to move up to the next level of growth, then a focus on productivity would be crucial.

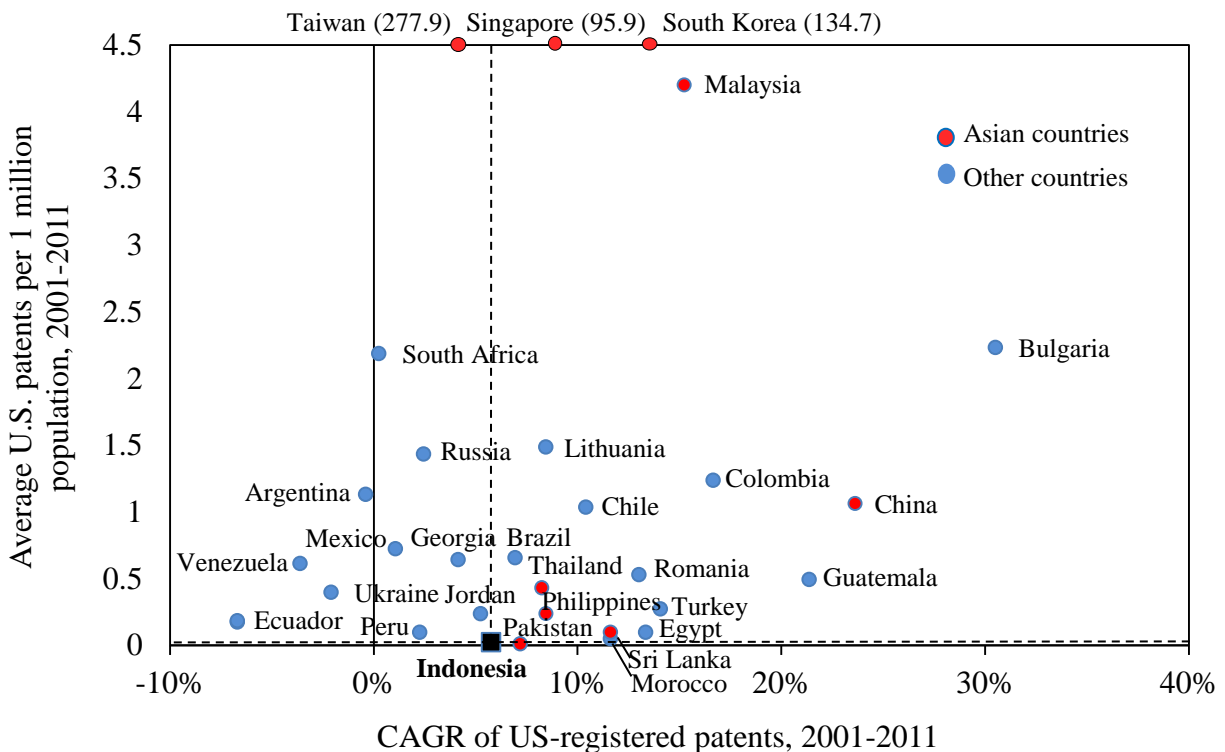


Source: Economic Intelligence Unit (2012).

Figure 2.8: Export Performance of Indonesia among Middle Income Countries

Appropriate sectors policy also needs to support technological acquisition and innovation, entrepreneurship, and worker skill acquisition and formation. As an example, Indonesia has lagged far behind other developing countries in the number of U.S. patents

received over the last decade (see Figure 2.9). If Indonesia were to move up the rank of the MICs group, then the country's corporate sector needs to start focusing on research and development for sustainable growth.



Source: Economic Intelligence Unit (2012).

Figure 2.9: Innovation Performance of Indonesia among Middle Income Countries

2.3.7. Expanding Intra-regional Trade

As the economic recovery of major industrialized economies has proven to be very gradual since the 2007-2008 global financial crisis, the longer term economic prospects of the global economy remain uncertain. As a result, Indonesia has to rethink its external balance

toward a more sustainable path. An important part of the external strategy is a greater reliance on intra-regional trade within the Asia-ex Japan region to replace some of the external demand normally originating from the US, Japan and the EU (see Table 2.4). Hence, trade policy that promotes intra-regional trades in final products is desirable, which can also lead to a more competitive intra-regional trade environment. This particular growth strategy will have policy implication for Indonesia's regional export destinations.

Table 2.4: Indonesia's Rising Dependence on China (export share)

	1990	1996	2000	2005	2006	2007	2008	2009	2010	2011
ASEAN	9.96	15.43	16.64	18.35	18.11	18.87	19.46	20.25	20.34	20.18
Japan	42.55	25.82	23.20	21.07	21.55	20.71	20.25	15.94	16.34	16.57
EU	12.30	15.99	13.68	12.02	11.81	11.32	11.09	12.34	12.20	12.37
China	3.25	4.12	4.45	7.78	8.27	8.48	8.49	9.87	9.95	11.27
US	13.11	13.61	13.66	12.27	11.16	10.20	9.55	9.35	9.06	8.11
India	0.23	1.06	1.85	3.36	3.36	4.33	5.23	6.38	6.28	6.55

Source: Central Bureau of Statistics, Indonesia.

2.4. Counterfactual Simulation

In this section, counterfactual scenarios are simulated with the use of dynamic FCGE model constructed in the previous chapter to further examine the rebalancing strategy discussed in Section 2.3.4. Consider a different state of the economy where the share of imports in

investment has changed in subsequent years after 2005. Counterfactual scenarios can then be experimented to observe the variation of investment demand by different sectors of destination. The results of these scenarios should indicate the magnitude and direction of the impact that imported capital goods can transmit on corporate sector's investment.

In order to implement the simulations, the domestic private investment function in the model (Eq. 58) must be modified to determine the effect of imported capital goods, as defined by the new variable *CAPIM*. Hence, the influence of *CAPIM* on private investment is specified in the following new relation:

$$INVES_{i,firm} = \lambda 0_{i,firm} \cdot (VA_i)^{\lambda 1_i} \cdot (1 + ss_{firm})^{\lambda 2_i} \cdot (CAPIM)^{\lambda 3_i}$$

where $INVES_{i,firm}$ is the corporate sector's investment in sector i , VA_i is value added goods, ss_{firm} is share of bank loan as determined by credit channel mechanism, and λ 's are shift and share parameters for the investment function. The shift parameter $\lambda 0_{i,firm}$ is calibrated within the modified model in this chapter. Meanwhile, the same share parameters are applied from the previous chapter, except $\lambda 3_i$ where the value for each sector of destination is estimated separately (see Table 2.5).¹²

Two opposite scenarios for higher and lower *CAPIM* are executed within the inter-temporal framework. In each scenario, *CAPIM* is adjusted by 10 percent deviations from the base value through a one-time shock in 2006. Scenario 1 simulates higher stock of imported capital goods, while lower stock of imports is depicted in Scenario 2.

¹² The share parameter $\lambda 3_i$'s are estimated from initial values of the investment function in base scenario from the previous chapter, in which its magnitude signifies the sensitivity of investment toward *CAPIM* fluctuations in each sector i .

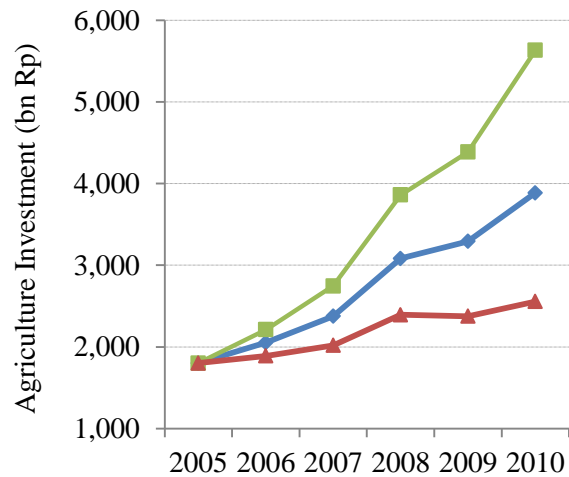
Table 2.5: Share Parameter for Import Capital Goods by Sector of Destination

Agriculture, Livestock, Forestry and Fishery	Mining and Quarrying	Manufacturing	Construction	Finance, Real Estate and Business Services	Other Services
0.863	0.228	-0.104	0.260	-0.062	-0.119

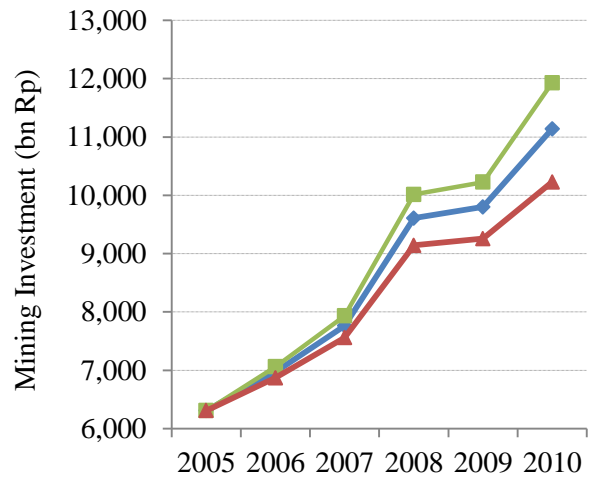
Note: Share parameter values for utilities, trade, and transportation and telecommunication sectors are assumed to be zero since no investment capital goods are imported for those sectors at base year 2005.

Source: Author's calculation.

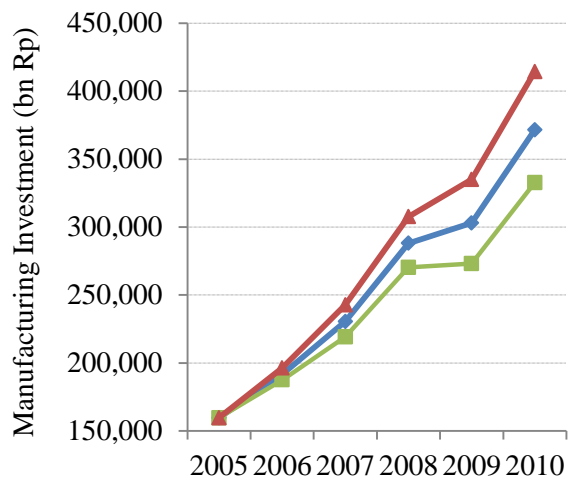
The results from the two scenarios are displayed in Figure 2.10. Higher imports of capital goods exert more private investment in agriculture, mining, and construction while sectors in manufacturing, finance and other services receive less investment. Agriculture seems to be the most sensitive sector toward *CAPIM* fluctuations due to its large share parameter value. On the contrary, lower imports of capital goods promote higher private investment in manufacturing, finance, and other services while lower investment is observed in agriculture, mining, and construction. This result implies that sectors in agriculture, mining, and construction are largely dependent on imported products for which the domestic capital goods industries have failed to supply. Hence, rebalancing strategies that promote the development of domestic capital industries should be implemented to accommodate growing sectors' demand for capital goods and stimulate higher pace of employment growth in the non-petroleum manufacturing sector.



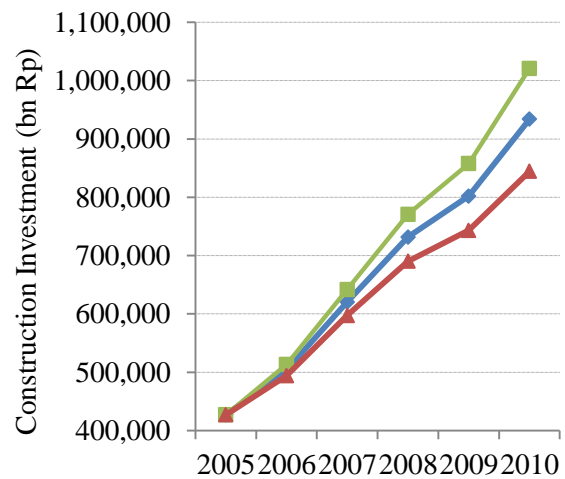
◆ Base Scenario
 ■ Scenario 1: High Import Capital Goods
 ▲ Scenario 2: Low Import Capital Goods



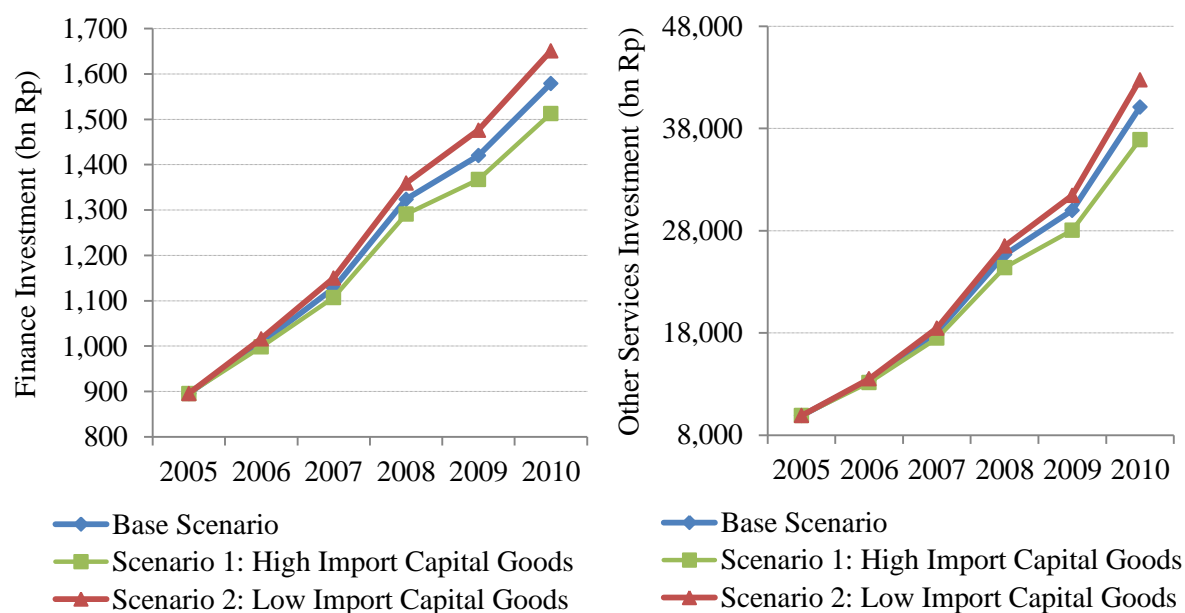
◆ Base Scenario
 ■ Scenario 1: High Import Capital Goods
 ▲ Scenario 2: Low Import Capital Goods



◆ Base Scenario
 ■ Scenario 1: High Import Capital Goods
 ▲ Scenario 2: Low Import Capital Goods



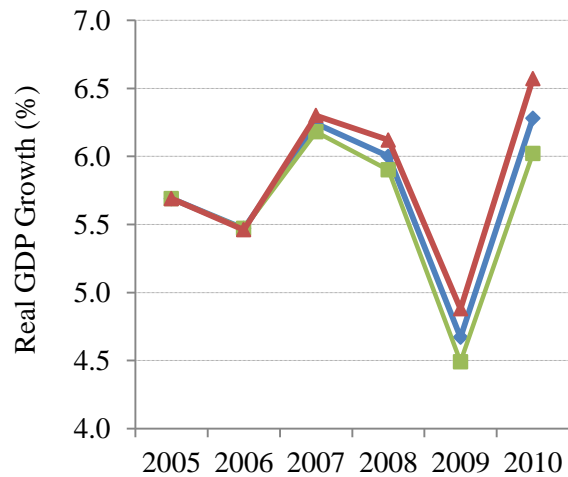
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 ■ Scenario 1: High Import Capital Goods
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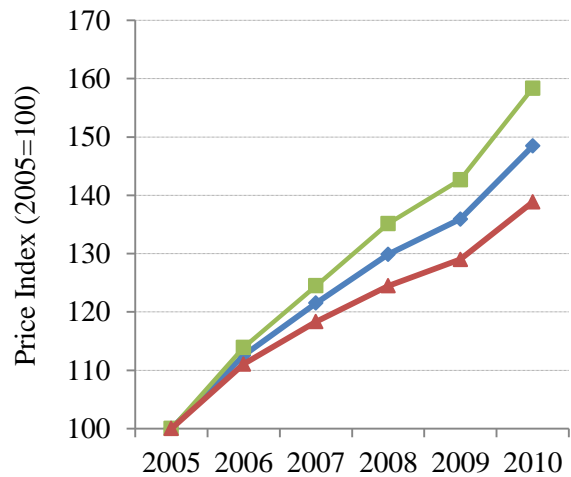
Source: Results of model simulation.

Figure 2.10: Trends for Sector Investment under Different Scenarios

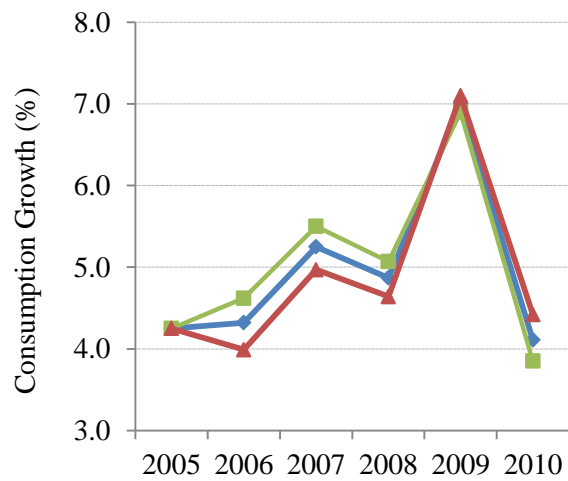
The impacts of investment capital goods on macroeconomic performances can also be observed in Figure 2.11. Lower imports of capital goods produce consistently higher rate of growth for real output and investment than that of higher imports, while higher trend of consumption growth picks up in 2008 onward. In addition, faster pace of unemployment drop and lower trends in price index and the nominal exchange rate are supported by import reduction of capital goods. As a result, the creation of new—and expansion of existing—capital goods industries in the economy should be maximized to realize its full potential impacts in achieving sustainable growth.



◆ Base Scenario
 ■ Scenario 1: High Import Capital Goods
 ▲ Scenario 2: Low Import Capital Goods



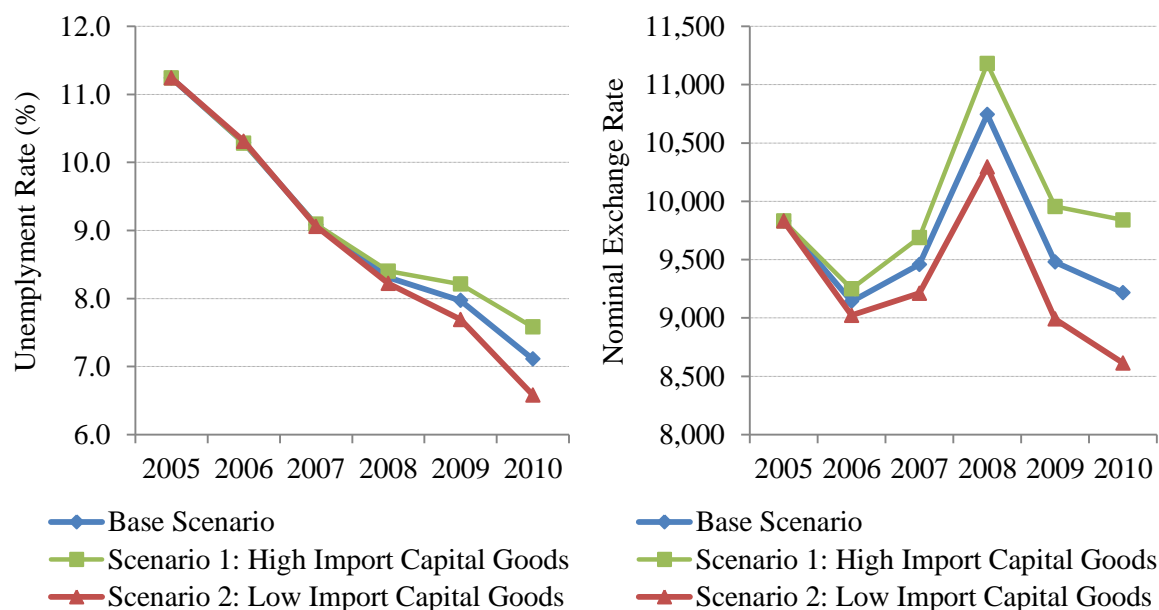
◆ Base Scenario
 ■ Scenario 1: High Import Capital Goods
 ▲ Scenario 2: Low Import Capital Goods



◆ Base Scenario
 ■ Scenario 1: High Import Capital Goods
 ▲ Scenario 2: Low Import Capital Goods



◆ Base Scenario
 ■ Scenario 1: High Import Capital Goods
 ▲ Scenario 2: Low Import Capital Goods



Source: Results of model simulation.

Figure 2.11: Trends for Macroeconomic Performances under Different Scenarios

2.5. Sensitivity Analysis

A set of key parameters most relevant to the counterfactual scenarios described in the previous section are the share parameter for imported capital goods ($\lambda 3_i$) in Eq. 58 and the elasticity-share-shift parameters of the Armington function ($bt_i, at_i, \rho t_i$) in Eq. 23. Hence, the stability of these four parameters is examined to test the robustness of the simulation results.

Table 2.6 shows that higher values of $\lambda 3_i$ in the investment equation lead to a rapid increase in the price index, and vice versa. These results confirm the notion that higher prices of imports can create cost-push inflation in the economy. Meanwhile, Table 2.7 through 2.9 shows an acceptable range of variations in the elasticity and parameters of the Armington function, which determines the optimal composition of domestic and imported intermediate input in the

production activities of the economy. For example, if domestic production required more domestically produced intermediate input (i.e., higher bt_i), then real GDP would rise dramatically with lower price index as observed in Table 2.8.

Table 2.6: Sensitivity on Share Parameter for Import Capital Goods in Investment Function

$\lambda 3_i$	$RGDP$	$PINDEX$	NX/GDP	$INVES_{AGRI}$	$INVES_{MANU}$	$INVES_{CONS}$
1.04	5.49	119.37	5.76	2,926	170,888	549,571
1.02	5.48	115.88	5.67	2,455	181,399	526,452
1.00	5.47	112.53	5.59	2,053	191,671	504,020
0.98	5.44	109.33	5.50	1,712	201,755	482,282
0.96	4.43	106.29	5.42	1,425	211,695	461,233

Note: NX/GDP is ratio of net export to GDP (%). $INVES_{AGRI}$, $INVES_{MANU}$, and $INVES_{CONS}$ are total private investment in agriculture, manufacturing, and construction, respectively (billions of rupiah).

Source: Results of model simulation.

Table 2.7: Sensitivity on Elasticity of Armington Function

ρt_i	$RGDP$	$PINDEX$	NX/GDP	$INVES_{AGRI}$	$INVES_{MANU}$	$INVES_{CONS}$
1.10	4.16	113.26	5.65	2,049	192,849	503,583
1.05	4.81	112.90	5.62	2,051	192,275	503,796
1.00	5.47	112.53	5.59	2,053	191,671	504,020
0.95	6.15	112.15	5.55	2,055	191,035	504,257
0.90	6.85	111.75	5.52	2,056	190,366	504,504

Note: NX/GDP is ratio of net export to GDP (%). $INVES_{AGRI}$, $INVES_{MANU}$, and $INVES_{CONS}$ are total private investment in agriculture, manufacturing, and construction, respectively (billions of rupiah).

Source: Results of model simulation.

Table 2.8: Sensitivity on Share Parameter of Armington Function

bt_i	$RGDP$	$PINDEX$	NX/GDP	$INVES_{AGRI}$	$INVES_{MANU}$	$INVES_{CONS}$
1.003	9.25	110.33	5.42	2,039	188,893	504,666
1.001	7.36	111.43	5.50	2,046	190,347	504,321
1.000	5.47	112.53	5.59	2,053	191,671	504,020
0.999	3.56	113.62	5.67	2,059	192,859	503,767
0.997	1.68	114.69	5.76	2,063	193,906	503,562

Note: NX/GDP is ratio of net export to GDP (%). $INVES_{AGRI}$, $INVES_{MANU}$, and $INVES_{CONS}$ are total private investment in agriculture, manufacturing, and construction, respectively (billions of rupiah).

Source: Results of model simulation.

Table 2.9: Sensitivity on Shift Parameter of Armington Function

at_i	$RGDP$	$PINDEX$	NX/GDP	$INVES_{AGRI}$	$INVES_{MANU}$	$INVES_{CONS}$
1.003	6.50	111.91	5.54	2,054	190,800	504,223
1.001	5.81	112.33	5.57	2,053	191,388	504,086
1.000	5.47	112.53	5.59	2,053	191,671	504,020
0.999	5.14	112.73	5.60	2,053	191,947	503,957
0.997	4.49	113.12	5.63	2,052	192,478	503,836

Note: NX/GDP is ratio of net export to GDP (%). $INVES_{AGRI}$, $INVES_{MANU}$, and $INVES_{CONS}$ are total private investment in agriculture, manufacturing, and construction, respectively (billions of rupiah).

Source: Results of model simulation.

2.6. Conclusion

This chapter has shed some light on the policy reforms that Indonesia can implement to achieve sustainable growth based on greater equity base in the long run, while contribute an

equalizing role in the overall adjustment process of the global economy from the excess of global imbalances. As a middle income country, Indonesia faces development challenges in which it should increasingly promote private investment, induce more public spending in rural areas, develop more capital goods industries, enhance good governance on public outlays, increase economic efficiency and productivity, and expand intra-regional trade. Concerted steps are also needed to change the current patterns of growth so that sectors with high potential for generating employment opportunities will grow faster. At the same time, Indonesia must continue to provide higher growth of employment and fight pockets of exclusion and poverty, as well as increase access to services and products better tailored to the needs of the population. Hence, overcoming all of these constraints will push Indonesia's economy to a higher growth trajectory and make the opportunities and benefits of growth more widely and equitably shared.

REFERENCES

- Azis, Iwan. 2007. "Managing Global Imbalances: The Role and Dynamic Effect of U.S. Interest Rate Policy." *Current Topics in Management* 12.
- Azis, Iwan, and Mario Lamberte. 2010. "ASEAN Imbalances and Rebalancing." Unpublished manuscript, Asian Development Bank Institute, Tokyo.
- Bernanke, Ben. 2005. "The Global Saving Glut and the U.S. Current Account Deficit." Remarks at the Homer Jones Lecture, St. Louis, Missouri, 14 April.
- Blanchard, Olivier, Gian Milesi-Ferretti. 2009. "Global Imbalances: In Midstream?" IMF Staff Position Note 29. Washington, DC: IMF.
- Fan, Shenggen, and Connie Chan-Kang. 2005. "Road Development, Economic Growth, and Poverty Reduction in China." Research Report 138, International Food Policy Research Institute, Washington, DC.
- Fan, Shenggen, Connie Chan-Kang, and Anit Mukherjee. 2005. "Rural and Urban Dynamics and Poverty: Evidence from China and India." Food Consumption and Nutrition Division Discussion Paper 196, International Food Policy Research Institute, Washington, DC.
- O'Neill, Jim. 2001. "Building Better Global Economic BRICs". Global Economics Paper No. 66, Goldman Sachs and Company.

Prasad, Eswar. 2009. "Rebalancing Growth in Asia." Working Paper 15169, National Bureau of Economic Research, Cambridge, MA.

Sussangkarn, Chalongphob, and Deunden Nikomborirak. 2011. "Trans-Pacific Rebalancing: Thailand Case Study." Working Paper 273, Asian Development Bank Institute, Tokyo.

CHAPTER 3

ASSET PRICE BUBBLE: AN ECONOMY-WIDE ESTIMATE AND POLICY IMPLICATION

3.1 Introduction

The recent global financial crisis of 2007 has sparked an intense debate in academic and policy circles regarding the appropriate regulatory responses to asset price bubble. Although the large gains and losses associated with dramatic shifts in asset price market have been well documented, surprisingly little consensus exists about the cause, characteristics, and policy responses on asset price bubble. By unraveling the factors that lead to and amplify asset bubbles, policymakers can determine the set of actions needed to safeguard the economy from faltering into financial crisis.

The impacts of the costly, destabilizing episodes of asset burst are obvious, but it is very hard for investors and financial market regulators to identify that an asset bubble has actually developed. It is nearly impossible to know for sure whether a given change in asset values results from fundamental factors, non-fundamental factors, or both. Despite this ambiguity, policymakers have more reasons to try to stabilize excessive asset growth due to its economy-wide repercussions on the market. Therefore, a new methodology to measure asset price bubbles becomes very important before policymakers can react to the corrective measure.

In theory, an asset bubble can be separated into a component determined by underlying economic fundamentals and a non-fundamental bubble component that may reflect price deviation from speculation, irrational investor euphoria, or depression. The expansion of an asset

price bubble may lead to a debilitating misallocation of economic resources, and its collapse may cause severe strains on the financial system and destabilize the economy.

Despite these potential problems, the appropriate policy response to an asset price bubble remains unclear and is one of the most contentious issues currently facing many central banks around the world. Kent and Lowe (1997) argued that monetary policy should be used to contain or reduce bubbles in order to alleviate their adverse consequences on the economy. Others argued that such a policy would be both impractical and unproductive given real-world uncertainties about the nature and existence of bubbles.

This chapter makes an attempt to answer the following three questions: (1) Does an asset price bubble increase the economy's vulnerability to a financial crisis? (2) How might policymakers choose between alternative courses of action when confronted with a possible price bubble in the economy? (3) Is restrictive monetary policy the best tool to deflate the bubble? Recent theory and empirical research has helped to clarify whether bubbles are rational and whether they occur. Nevertheless, this recent work merits an appropriate policy response to asset price bubble because it is increasingly sophisticated, voluminous, and controversial.

This chapter is organized into eight sections. The next section describes the current literature on asset price bubbles. Section 3.3 presents new balance sheet mechanism as a plausible origin of asset bubble. Section 3.4 illustrates the model framework to estimate an economy-wide measure of a price bubble in corporate equities. The generated price acceleration of the asset is revealed in Section 3.5, and its impact on the economy's vulnerability to financial crisis is discussed in Section 3.6. Simulation results of alternative policy option are analyzed in Section 3.7. Section 3.8 concludes the chapter.

3.2. Literature Review

It is quite easy to find studies on asset price bubble in the last decade. However, no study has ever examined the macroeconomic vulnerability of bubbles to a financial crisis. It is worth noting that all financial crises in the past have been preceded by asset price bubble. However, the obstacle emanates from the fact that no definite rules or theoretical foundation clarify the issue of price bubble at the moment. Rather, the studies are usually based on empirical and real phenomena observations.

Bernanke and Gertler (1999) developed a financial accelerator model in which information problems and capital market imperfections could explain why financial asset prices deviated from fundamentals and exerted a specific influence on economic development. The model generated an impact of financial asset prices mainly through wealth effects on consumption and net worth or collateral effects on firms' investment decisions. However, the analysis excluded direct impact on investment through the non-fundamental asset price, where investment decisions were based only on the fundamental value of the projects. Bernanke and Gertler concluded that a monetary policy that is concentrated on targeting inflation with a strong response on expected inflation and potentially the output gap is the appropriate monetary policy strategy. In their view there was no need to have a specific response to asset prices. However, because the analysis was done in a linearized version of the model, they failed to address the policy implications of the non-linear response to various shocks.

Caballero and Krishnamurthy (2006) developed a model of bubbles in emerging markets as a result of their inability to generate reliable financial assets. When local bubble crashed, countries needed to seek store of value abroad. They conjectured that this pattern also could arise

from fundamental shock due to a change in public perception of the soundness of the financial system and local conglomerates and degree of ‘cronysm’, among others.

On the policy front, discussions have generally been made along the issues of financial regulations and macroeconomic impacts of asset price bubble. Blanchard and Watson (1982) pointed out that growing bubble could have harmful real effects on the economy, by drawing out inefficient supply at high prices, or making asset price a poor signal (see also Friedman, 1984). Furthermore, Mishkin (2001) found positive linkages between stock prices and household wealth and liquidity effects. He surveyed the transmission mechanism of monetary policy through asset price channel, particularly stock prices, real estate prices, and exchange rate effect that influence investment and consumption decision of both firms and household.

From modeling perspective, the expanding literature in behavioral finance and experimental asset markets has gained acceptance because of the great difficulty in explaining the level of financial volatility by models based solely on economic fundamentals. Advocates of bubbles would probably be forced to admit that it is difficult or impossible to identify a particular episode conclusively as a bubble, even after the fact. Hence, there is a large gap in the literature for measuring asset price bubble in the market. Most importantly, there is no other economic or financial model that can explicitly describe the connection between asset price bubble and welfare-linked indicators. A strictly analytical model in the form of experimental asset markets simply cannot handle the numerous variables involved and the complex relationship among them.

Although asset markets may at the core be determined by psychological attitudes of market participants, what is more important for policy maker is whether or not changes in asset prices reflect changes in the market fundamentals. It is not of any great importance whether the

bubble can be explained in terms of rational expectations or by psychological factors, but a more significant issue is the process that excessive asset growth can generate to affect macroeconomic performances that potentially harm the stability of the financial system and economy as a whole.

3.3. Balance Sheet Mechanism

This section synthesizes a new strand of analysis for the cause of asset price bubble through balance sheet mechanism. In particular, asset price bubble can be generated through a series of continuous upward adjustment in corporate leverages during business cycle growth (e.g., stock market boom, low interest rate condition, etc.). In the old paradigm, corporate's decision to raise capital is based on the value of its assets. That is, it is typically the case that the capacity to borrow cannot exceed the value of assets that the corporate owns. In the new paradigm, corporate raises new funds through various debt instruments in capital markets to finance their operations and investments no matter how much worth of assets they own (e.g., corporations can rely on non-asset collaterals to support their levered positions).

Furthermore, rapid increase in stock prices during boom times makes it easier for the corporate sector to finance new projects, causing domestic private investment to flourish. Driven by market optimism and liquidity trading, businesses choose to continue to leverage their balance sheet to finance capital expenditures. Debt issuance is also preferred due to its lower cost than equity issuance. The resulting higher debt leads to an increase in the firms' liabilities and an equal increase in the market value of the assets (i.e., by virtue of balancing accounting equation, *ceteris paribus*). However, the stock of assets may not grow as rapid as the stock of liabilities. Consequently, the price of the relevant assets must adjust upward, triggering an inflated asset price condition. This price inflation defines a new process in the formation of asset bubble in the

economy, in which a temporary deviation of price value exists from the asset's fundamental value in the market.

As a result, asset price bubble in this analysis is defined as a continuous acceleration in the price of asset, with the initial rise producing stronger balance sheet for further leverage adjustment and, hence, further increase in the asset price. Hence, a bubble exists when the price of the asset does not equate to its market fundamentals price for some period of time for reasons other than random shocks. The fundamental price of the asset is defined to be the long run equilibrium price consistent within a general equilibrium framework. In practice, the asset's 'fundamentals' are referred to the economic factors such as the supply and demand of the asset and its rate of return that together determine the price of the asset.

The following section illustrates the model that is meant to be an accessible approach to measure excessive asset growth in an economy-wide framework when the particular asset price does not appear aligned with the fundamentals. The price of the underlying fundamentals is measured by the appropriate baseline equilibrium price of that particular asset. When growth of asset price is sustainable in the long run, the resulting price path of the asset can be viewed as the steady state equilibrium path.

3.4. Model Framework

This chapter employs a dynamic financial computable general equilibrium (FCGE) model to capture the process of the bubble formation in the market through balance sheet mechanism. The model allows for the possibility that the generated asset prices differ persistently from the market's fundamentals price. In the general equilibrium framework, this fundamentals price is

derived from the supply and demand forces that generate the long run equilibrium asset price in the financial market under no external shocks. Prices that are generated significantly beyond the long run equilibrium price benchmark can be identified as a price bubble by the model.

Accordingly, the original FCGE model constructed in Chapter 1 is extended to track the price of specific financial asset and capture additional macroeconomic indicators within the inter-temporal framework. The main data system remains the same, Indonesia's financial social accounting matrix (FSAM) 2005, and it is used to calibrate the model to the base period along with the same sequence of dynamic calibration conducted in the original model.

The basic structure of the real sector follows a nested structure that connects production and goods market. Production sectors employ labor, non-labor, and intermediate inputs to produce domestic output. Specified by the constant elasticity of transformation function, some portions of the outputs are exported and some are sold domestically. The substitution between domestic goods and exports is assumed to be imperfect. To serve domestic demands, composite goods are made up of domestically produced goods and imports. This substitution between domestic and imported goods is determined by the Armington function, which also assumes imperfect substitution. This nested structure and imperfect substitutions allow adjustment of prices and quantities of goods due to external shocks.

In the labor market, wages are partly rigid, implying that unemployment is determined to be endogenous. Factor demand for each production sector is derived from the first order condition, which depends on a set of variables such as the value added production, factor price, and productivity growth. In turn, the wage rate for each sector is determined by the factor demand, price of value added goods, and the inflation rate. Hence, wage rate for each sector of destination is endogenously derived in the model. A key implication underlying the equation

form of wages is the prevalence of labor market segmentation with wages being strongly sector-specific.

In theory, an external shock to financial institutions can have an impact on the financial market, other institutions, and the real sector (Tobin, 1970). These linkages are established in the financial block of the model, which primarily exploits the capital account of each institution. Domestic private investment is determined to be endogenous through an independent behavior function. Savings is a part of balance sheet that represents the change in the institution's wealth (i.e., flow of wealth). This saving is eventually absorbed into various types of financial asset as well as investment in the real sector. The interaction among the financial market and real sector holds the key to the transmission mechanism of an exogenous shock in the model.

The structure of the portfolio behavior varies across institutions, depending on the type of assets and liabilities that each institution holds. Each asset type has its own rate of return, which determines how portfolio allocation decisions are made. In particular, the rate of return for saving and time deposit, government bond, and equities are determined to be endogenous, while others are fixed to determine the equilibrium supply and demand of the corresponding asset in the market.

The inter-temporal structure of the model has n discrete time horizon, in which markets are at equilibrium and economic agent behaviors are optimized in each period. Capital stock at time t is consisted of the lagged capital stock depreciated at the rate δ_1 and lagged investment demand accumulated at the rate δ_2 . This specification allows previous investment to affect present production activities, thereby constituting an inter-temporal mechanism for the model.

Using General Algebraic Modeling System (GAMS) application, all of the equations in the dynamic FCGE model are solved simultaneously to give quantitative result that constitutes

the ‘base run’ scenario. A new shock to the exogenous variables and/or parameters can be numerically analyzed as a ‘simulation’ scenario compared to the base run scenario.

Finally, it is worth noting that the generic FCGE model in this chapter excludes rational expectation modeling to simplify the analysis of the price path of the excessive asset growth and its policy implication. Under rational expectation, price paths are indeterminate because there are two variables to solve for each period (i.e., prices and expectations), but there is only a single condition constraining market equilibrium and rationality of expectations (Flood and Garber, 1982). The next section illustrates the use of the model to generate endogenous price path of a particular asset bubble.

3.5. Endogenous Price Bubble

In reality, changes in the price of asset can influence the institution’s preference to invest in that particular asset. For instance, financial investment in stocks and bonds depends largely on their price and yield in the market. If stock prices were high and bond yield were low, the decision would then be no investment in those assets. Hence, it is important that the simulation exercise in this section is able to capture the price of the asset explicitly to make the intended analysis more meaningful.

For simple illustration, stock that consists of corporate shares and equities will be used to simulate the price bubble in the model economy.¹³ In equilibrium, stock supplied by the

¹³ Note that other types of financial or fixed asset can be used. Tirole (1982, 1985) suggested the types of asset that might be subject to price bubbles. First, asset must be durable, because an expectation of resale value is needed to generate a bubble. Second, scarcity or short-run supply inelasticity is important because an asset that can easily be produced if a bubble occurs (like similar paintings by a living artist) will drive prices down and burst the bubble. Third, bubbles may require an active market for assets and a social mechanism for coordinating the common belief that a bubble exists and will continue to grow.

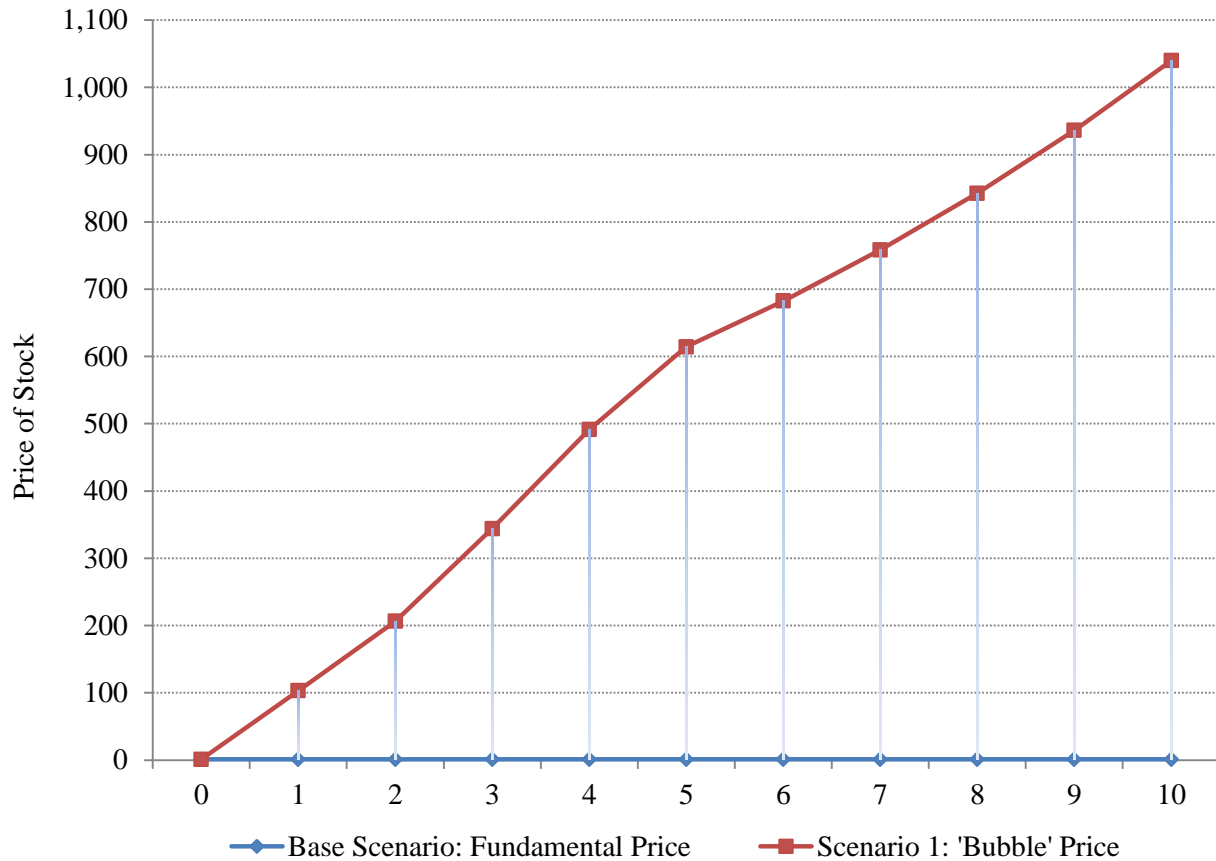
corporate sector is determined by the demand for the asset by other institutions in the market. Therefore, the supply and demand of stock is to be captured in the following new relation:

$$PEQ \cdot EQQ = Liab_{NFin,FF-EQY}$$

where $Liab_{NFin,FF-EQY}$ is the supply of stock from non-financial corporations, PEQ is the price of stock in the market, and EQQ is the quantity of available stock in the market.

Consider an easy money environment (i.e., low interest rate, cheap credit line, etc.) that can be simulated by a series of negative interest rate shocks, which allows the corporate sector to take on cheaper loan and, thus, higher debt at time $t = 1$ through a finite horizon. Given some fixed quantity of stock (\overline{EQQ}) available in the market, an arbitrary price bubble for the asset exists if and only if PEQ is observed to be significantly higher than the corresponding price generated at base run scenario while the equilibrium condition is satisfied; that is, the price increase for stock is equal to the increase in the corporate sector's supply of the asset in each time t .

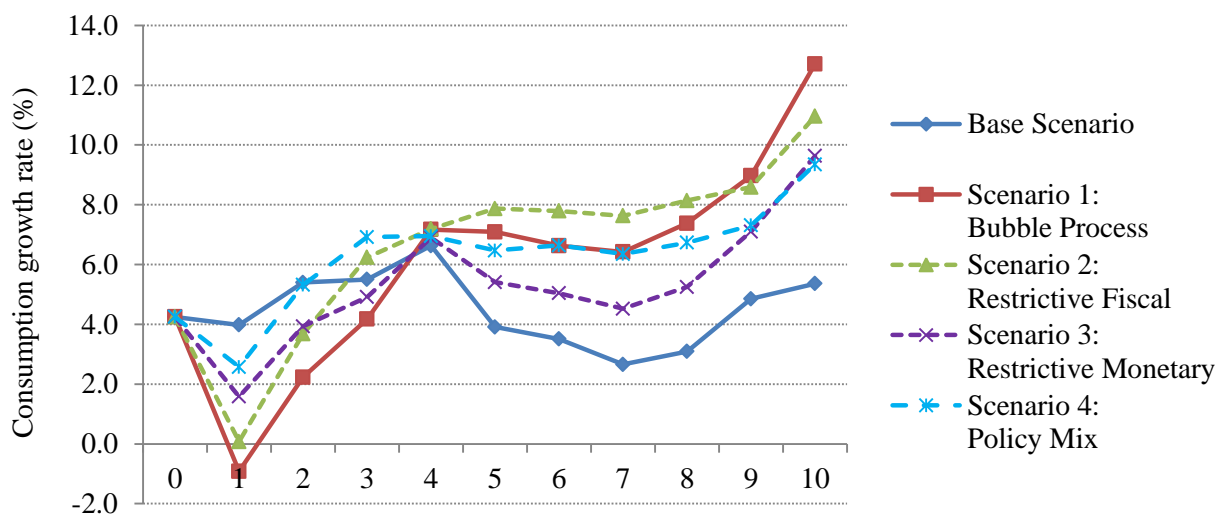
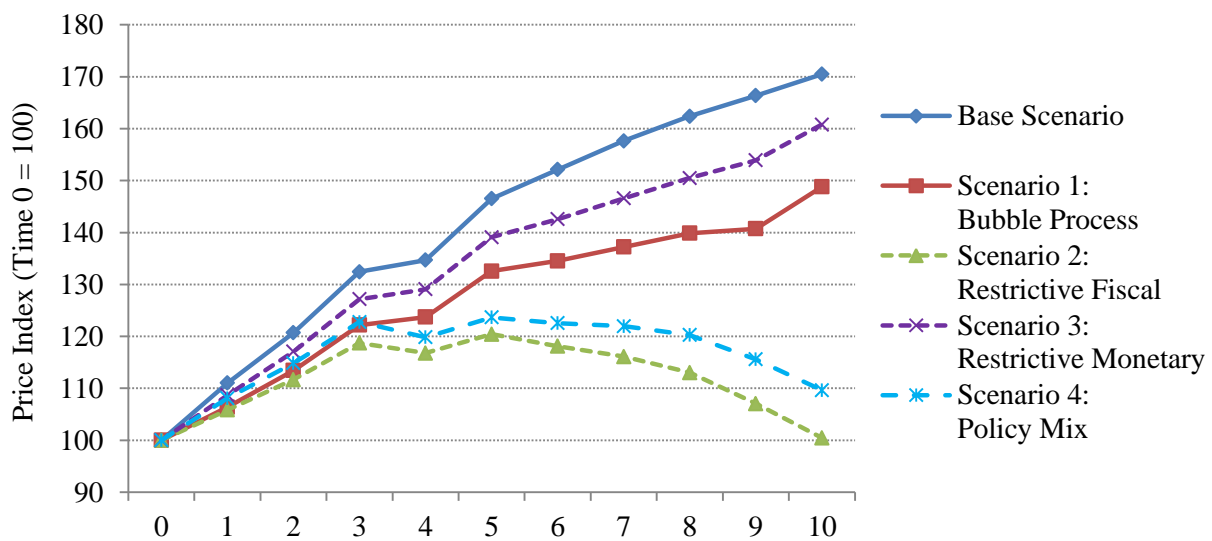
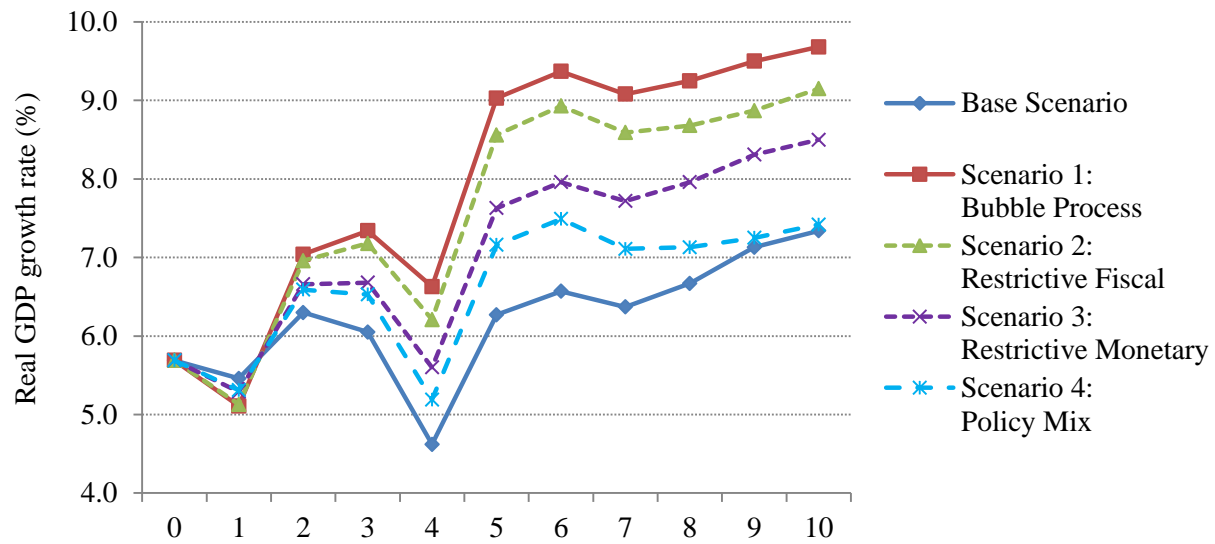
Figure 3.1 displays a stock price 'bubble' generated in the model economy by a 100 basis point decrease from the prevailing benchmark interest rate (RN_{assbi}) in each period, in which the price at $t = 10$ deviates approximately 1,040 times higher than the base price (Scenario 1). The upper price path represents the bubble components of the stock price due to the 'liabilities adjustment' factor described earlier, while the lower price path is the equilibrium price of stock based on market fundamentals with no external shock (Base Scenario). The resulting gap is the unexplained component of the asset price movement, consistent with the view that non-fundamental forces carry prices beyond the level consistent with underlying determinants of the asset.

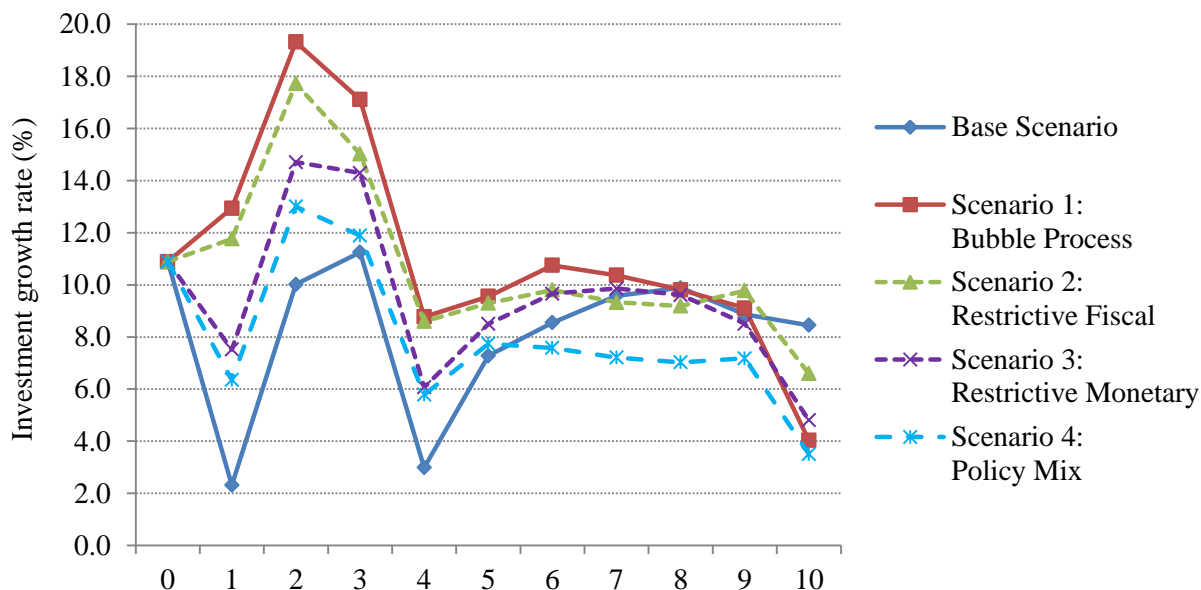


Source: Results of model simulation.

Figure 3.1: The Economy-Wide Estimate of Asset Price Bubble

Figure 3.2 reveals the macroeconomic impact of the stock price bubble. Scenario 1 produces significantly higher growth of real GDP than Base Scenario (i.e., without bubble), while lower path of the price index is observed. The bubble process also exerts higher growth of investment through $t = 8$, whereas consumption growth picks up in subsequent periods after $t = 4$. These results are seemingly in line with the characteristics of a bubble economy, in which the macroeconomic indicators reveal ‘artificially’ strong performances in the backdrop of an easy money environment.



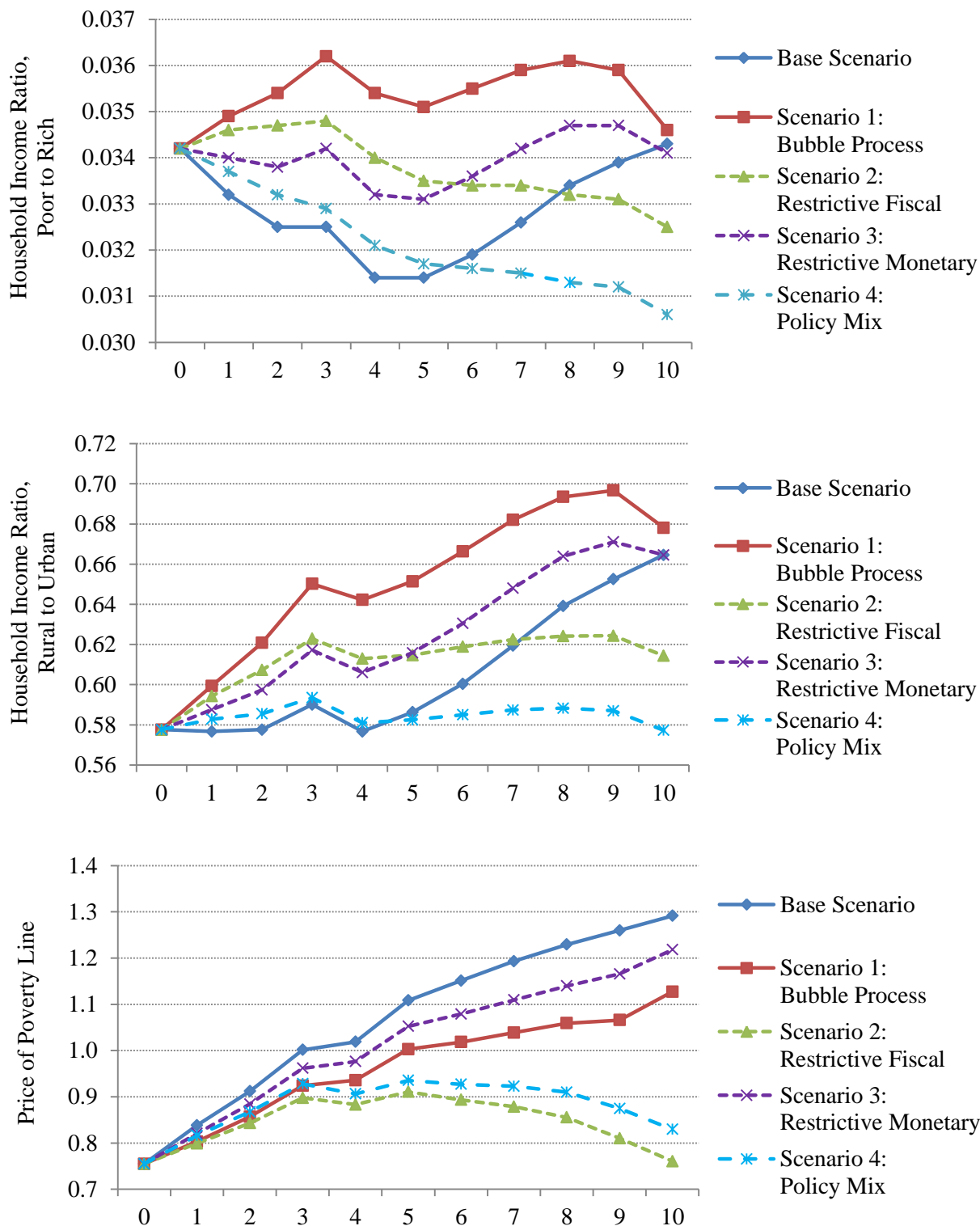


Source: Results of model simulation.

Figure 3.2: Bubble Effect on Macroeconomic Variables under Different Scenarios

On the welfare front, stock price bubble improves the equity distribution of the population (see Figure 3.3). The bubble process also generates lower path in the price of poverty line ($PLTOT$) than the ‘business-as-usual’ condition, which suggests that some poor households may likely move out of the subsistence level during the bubble process.

Finally, bubble path tends to burst if sustained for sufficiently long horizon, in which the price of equities will eventually fall. The price decline may soften when firms began to increase the stock of equities enormously, arguably to boost the intrinsic value closer to the bubble price and prevent it from busting. However, for the purpose of the analysis, the simulation exercise in this section has been conducted to preserve the bubble path through the end of the time horizon. Therefore, the bubble path is not to be viewed as the steady state equilibrium path, and that further macroeconomic repercussions of price bubble can be assessed in the next section.



Source: Results of model simulation.

Figure 3.3: Bubble Effect on Welfare Indicators under Different Scenarios

3.6. Bubble Assessment to Financial Crisis

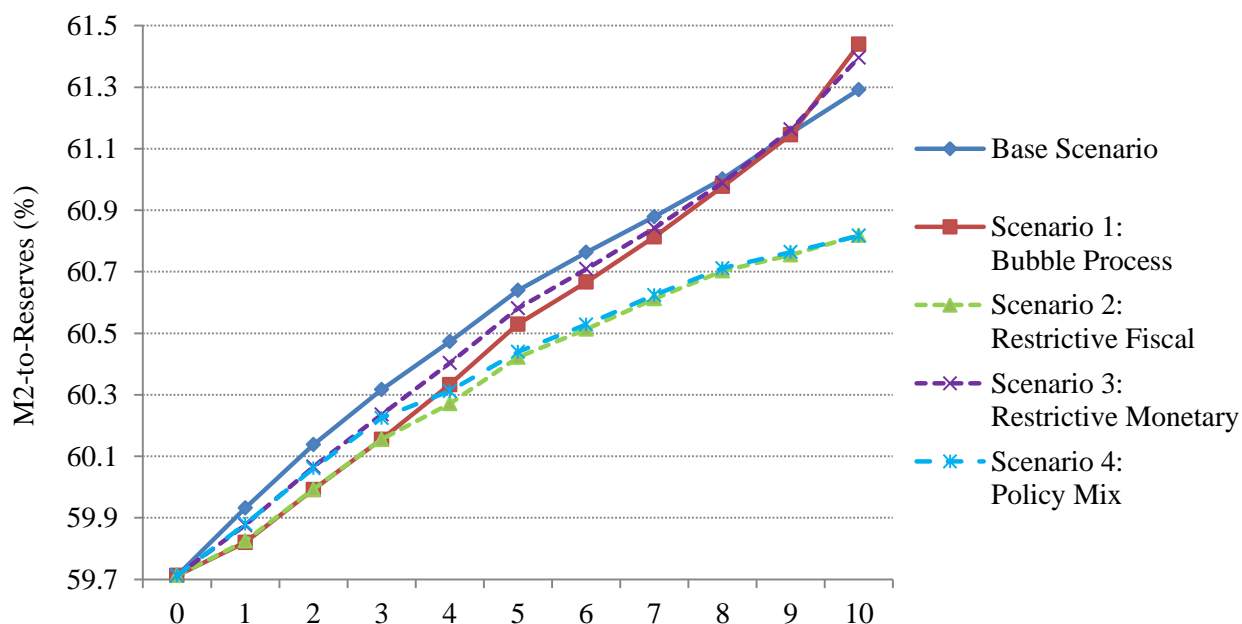
This section explores the potential path of stock price bubble to economic fallout that fiscal nor monetary policy cannot readily offset after the fact. Despite the bubble's capacity to produce strong macroeconomic performances as shown in the previous section, all financial crises of various types in the past have been preceded by an asset price bubble. In the event of a bubble crash, asset value takes a drastic plunge and institutions' balance sheet will severely be damaged by the collapse of the market. As a result, additional trends of macroeconomic fundamentals should be analyzed to observe the likelihood that the economy can fall into financial crisis due to a price bubble. If the trends of the fundamentals were instable, then the prevailing price bubble would be a crisis prone condition.

The first macroeconomic fundamental analyzed is the ratio of broad money supply (M2) to the central bank's official reserves asset, which reflects the potential rate of currency substitution in the foreign exchange market.¹⁴ Therefore, a dramatic increase in the M2-to-reserves ratio generates greater likelihood of macroeconomic disturbances caused by the substitution of domestic currency in the market.

Figure 3.4 depicts an increasing trend in M2-to-reserves for Scenario 1, where the path of the money supply ratio follows closely to Base Scenario. This result suggests a bubble economy generates insignificant impact on the money supply ratio, while ensuring financial stability against external shock in the foreign exchange market. Nevertheless, the insignificant impact is seemingly transitory, in which the trajectory of M2-to-reserves follows a rapid increase starting at $t = 9$. This dramatic surge of money supply relative to the central bank's reserves stock

¹⁴ M2 consists of M1 (i.e., currency in circulation and demand deposit at the banks), savings deposit, and time deposit.

holding should be assessed further to determine the long-term impact of the price bubble on the stability of the fundamentals.

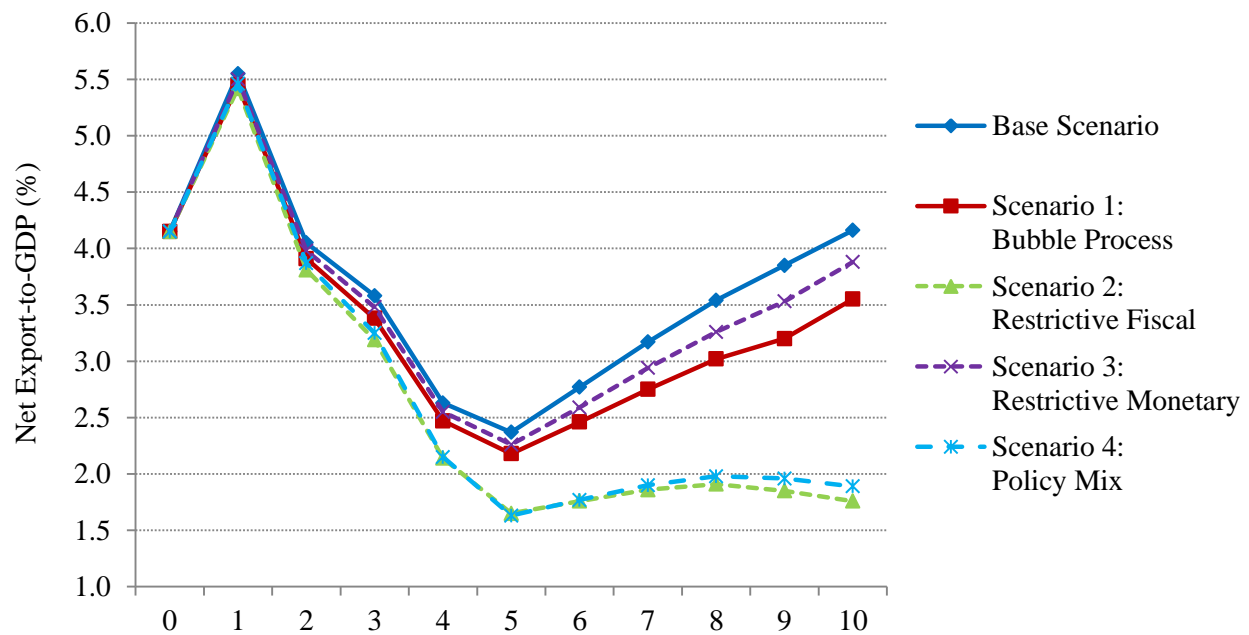


Source: Results of model simulation.

Figure 3.4: Trend for M2-to-Reserves under Different Scenarios

The second macroeconomic fundamental is the ratio of net export-to-GDP. Trade statistic typically makes up the largest share of a country's current account balance. Therefore, any change in net export would reflect new trajectory of the current account dynamics in a given period. If net export dropped more than five percent within a two-period horizon, then the current account balance would be instable and the economy would tend to be vulnerable to stock price bubble.

Figure 3.5 depicts lower ratio of net export-to-GDP for Scenario 1, in which its path tracks similar movement in Base Scenario. This result clearly suggests that there is insignificant impact that a bubble economy can produce on net export ratio, which also implies stable external balance in a bubble economy.

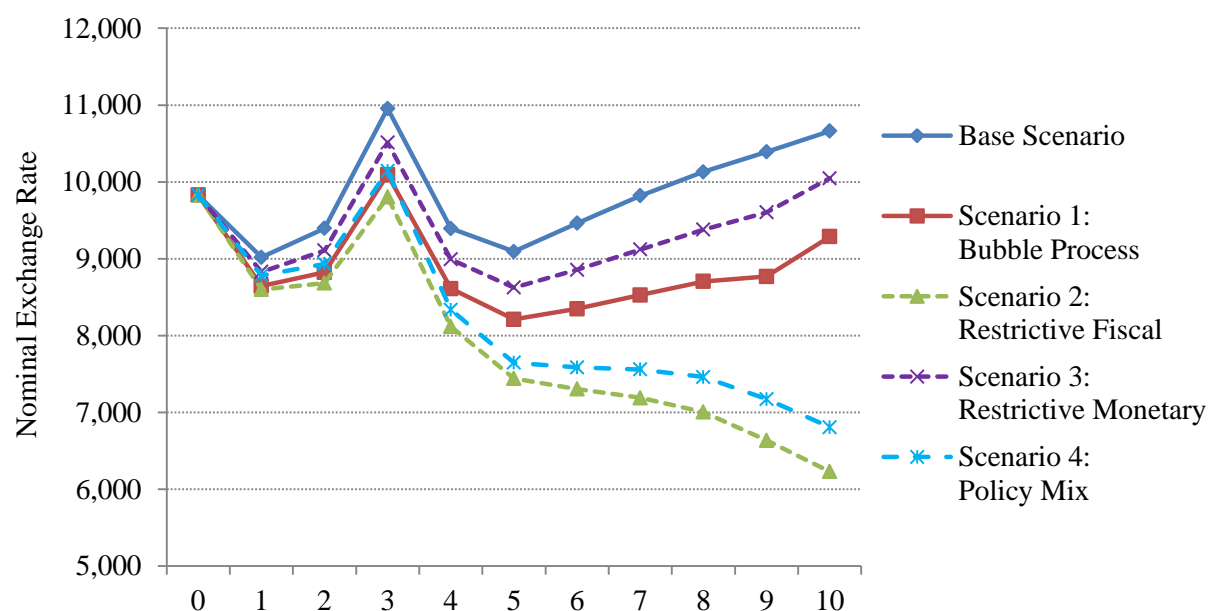


Source: Results of model simulation.

Figure 3.5: Trend for Net Export-to-GDP under Different Scenarios

The third macroeconomic fundamental is the volatility of nominal exchange rate (EXR). If the magnitude of EXR volatility reached 20 percent within a two-period horizon, then the exchange rate market would be perceived unstable, and the economy may experience greater likelihood of financial crisis.

Figure 3.6 shows that bubble process can strengthen the domestic currency; however, it has no effect on the volatility of the exchange rate. This result concludes that the exchange rate market remains resilient in a bubble economy, and it preserves the strength of the macroeconomic fundamentals from Base Scenario.



Source: Results of model simulation.

Figure 3.6: Trend for Exchange Rate under Different Scenarios

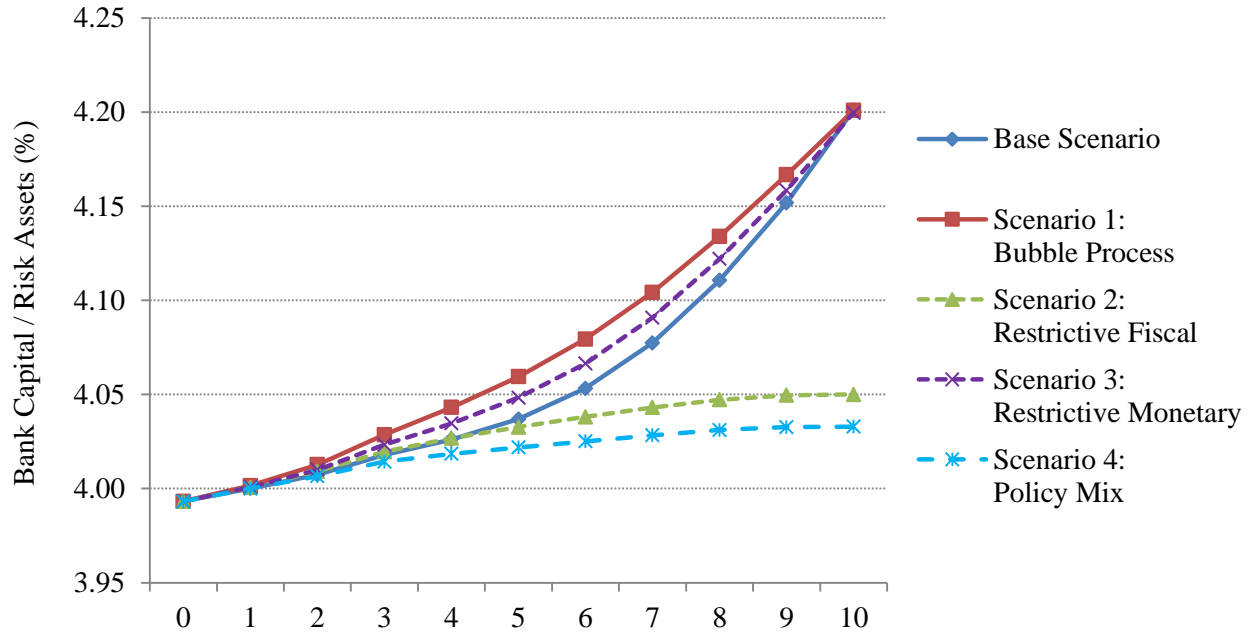
The last fundamental analysis to be considered is a stress test for the banking industry, which is implemented as if large domestic banks could survive even a severe recession and still have enough capital to keep lending. Stress test is a tool to gauge the resiliency of the financial sector, which suggests banks to hold larger reserves against riskier loans and investment. If banks fell below a certain guideline for how much capital would be needed in a downturn, then

those particular banks would need to be monitored closely.¹⁵ In practice, the test would involve running hypothetical exercises on how much the banks would lose and for how long from a combination of loan write-downs and the falling value of securities in a recession with high unemployment level and stock market downturn. In a dynamic FCGE framework, this test can be measured by the ratio of bank's wealth (i.e., the net worth of the bank) to total risk assets in its financial portfolio. These risk assets consist of long-term non-government securities, working capital credit, investment credit, consumption credit, non-bank credit, trade credit, and corporate shares and equities.

Figure 3.7 shows higher trajectory of bank capital ratio for the bubble process. The result suggests that bubble condition can modestly enhance bank capital and, thus, increase stability of the banking sector. As a result, the capital base of financial intermediaries remain resilient in a bubble economy insofar they can continue to lend to consumer and businesses, even in the case when the bubble deflates.

In the next section, three different policy simulations are conducted to mitigate the potential negative repercussions that a price bubble can generate in the economy. The results of these simulations should give an indication of the magnitude and direction of the impact that the policy can influence on the bubble process.

¹⁵ Basel III, a global regulatory standard on bank capital adequacy introduced, requires banks to hold 4.5 percent of common equity and 6 percent of Tier I capital (i.e., common shares and retained earnings) of risk-weighted assets for capital buffers.



Source: Results of model simulation.

Figure 3.7: Trend for Bank Stress Test under Different Scenarios

3.7. Policy Simulation

The role of fiscal and monetary policy to respond stock price bubble is analyzed through a set of counterfactual policy simulations. The first policy simulation is a restrictive fiscal policy in which government spending is cut by five percent across all sectors (Scenario 2). The second policy simulation is a restrictive monetary policy in which the benchmark interest rate is adjusted by a 50 basis point increase from the prevailing rate in the bubble economy (Scenario 3). The third simulation is a policy mix of the fiscal and monetary policy enacted in the previous policy simulations (Scenario 4). These three different simulations are executed by a one-time shock at $t = 1$, and the results are displayed in Figures 3.2 through 3.7 to track their deviations from Scenario 1, which reflects the bubble process.

The results of the three simulations show that the implementation of the fiscal, monetary, and policy mix can each slow the pace of real GDP growth from that artificially achieved in Scenario 1. Fiscal restriction seems to have the least effect, while policy mix has the largest effect on reducing the output growth closer to Base Scenario (i.e., without bubble). The results also reveal that all three policies can smooth out private consumption and investment from the bubble process. Similarly, fiscal restriction has the least impact, while policy mix has the largest impact on reducing the artificially high growth of consumption and investment closer to Base Scenario.

On the welfare front, all three policy options lead to worsening income inequality between the poor and rich, as well as the rural and urban household groups. However, monetary contraction seems to generate modest welfare repercussion, in which the trend of income inequality remains strictly above Base Scenario.

In terms of macroeconomic fundamentals, a drastic fiscal measure or policy mix strategy reduces money supply ratio, while tight monetary generates a relatively higher path than the bubble process scenario. Fiscal or mix policy can also dramatically produce lower trade balance, while monetary tool delivers the trajectory of net export ratio closer to Base Scenario. In the foreign exchange market, fiscal or policy mix can strengthen the domestic currency in response to the price bubble, while monetary policy triggers depreciation that brings the exchange rate closer to Base Scenario. Finally, bank capital ratio is stagnant when spending cut or policy mix is enforced separately in a bubble economy, while interest rate hike preserves the path above Base Scenario.

Accordingly, a standalone restrictive monetary policy is seemingly the most favorable option to mitigate the potential impact that stock price bubble can generate in the economy.

Monetary contraction is capable to produce more modest adjustment than its fiscal counterpart and mix policy strategy in reducing the pace of growth in output, consumption and investment than those produced by the bubble process. Monetary policy can also limit the worsening distribution impact of policy enactment, while resilience of the banking sector is more likely to be realized under interest rate effect than fiscal contraction or policy mix strategy.

Restrictive monetary policy also responds to an asset price only insofar as it conveys information to the central bank about the future path of output and inflation—the target variables of monetary policy. For example, a stock market boom is usually followed by stronger domestic demand and increased inflationary pressure, so tighter monetary policy is certainly needed to offset these consequences. In addition, price bubbles can be a pernicious source of macroeconomic risk and may exhibit more volatile dynamics, so even the most appropriate policy intervention in the bubble economy may react more to price bubbles than to movements in the fundamental component.

3.8. Conclusion

Excessive growth of asset prices is a common concern among investors and financial market regulators. In the usual textbook benchmark case, a world of efficient capital markets and without regulatory distortions, movements in asset price simply reflect changes in underlying economic fundamentals. Nevertheless, excessive asset growth can become an independent source of macroeconomic instability when non-fundamental factors underlie market volatility, and changes in the asset price unrelated to fundamental factors have potentially significant impacts on the rest of the economy.

This chapter has examined a new balance sheet mechanism through which leveraging process can lead to the formation of asset price bubble in an easy money environment. A dynamic FCGE model is employed to produce an endogenous process of stock price bubble, while macroeconomic performances and fundamentals are monitored to determine the stability of the economy in a bubble economy. Furthermore, the role of fiscal, monetary and policy mix is each examined for their impact on the bubble process in order to avoid extreme longer term effects of a larger bubble and its eventual collapse. The results of the policy simulations indicate that monetary contraction in respond to bubble economy is seemingly the optimal policy choice in preserving the natural growth of the real GDP, consumption, investment and bank capital ratio, while minimizing the deteriorating welfare impact of policy enactment.

Finally, in an ideal setting, asset price boom can be modeled as an endogenous process that is related to uncertainty and heterogeneous expectations about fundamental shocks. Alternative monetary policy rules may affect the probability of asset price booms and bursts in such a setup. Asymmetric policy rules may also create a moral hazard issue by providing one-sided protection against the negative risks. Understanding these mechanisms together with more knowledge about the transmission mechanism from these financial variables to the real sector will make the policy conclusions of this type of research much more robust. Introducing financial frictions and capital market imperfections, firm-specific capital and heterogeneous agents will certainly be ingredients for future research in this context.

REFERENCES

- Armington, Paul. 1969. "A Theory of Demand for Products Distinguished by Place and Production." *IMF Staff Papers* 16 (1): 1268-1290.
- Azis, Iwan. 2002. "What Would Have Happened in Indonesia if Different Economic Policies had been Implemented When the Crisis Started?" *The Asian Economic Papers* 1 (2): 76-103.
- Bernanke, Ben, and Mark Gertler. 1999. "Monetary Policy and Asset Price Volatility." In *New Challenges for Monetary Policy*, Proceedings of the Symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming.
- Blanchard, Olivier, and Mark Watson. 1982. "Bubbles, rational expectations, and financial markets." In *Crises in Economic and Financial Structure*, ed. Paul Wachtel. Lexington, MA: Lexington Books.
- Filardo, Andrew. 2001. "Should Monetary Policy Respond to Asset Price Bubbles? Some Experimental Results." In *Asset Price Bubbles: Implications for Monetary and Regulatory Policies*, ed. George Kaufman, 99-123. Oxford: Elsevier Science.
- Flood, Robert, and Peter Garber. 1982. "Bubbles, runs, and gold monetization." In *Crises in the Economic and Financial Structure*, ed. Paul Wachtel. Lexington, MA: Lexington Books.
- Friedman, Benjamin. 1984. "Stock prices and social dynamics: Comments and discussion." *Brooking Papers on Economic Activity* (2): 504-508.

- Garber, Peter. 2000. *Famous First Bubbles: The Fundamentals of Early Manias*. Cambridge, MA: MIT Press.
- Kent, Christopher, and Philip Lowe. 1997. "Asset-price bubbles and monetary policy." Reserve Bank of Australia Economic Research Department Discussion Paper 9709. December.
- Mishkin, Frederic. 2001. "The Transmission Mechanism and the Role of Asset Prices in Monetary Policy." Working Paper 8617, National Bureau of Economic Research, Cambridge, MA.
- Shiller, Robert. 1978. "Rational expectations and the dynamic structure of macroeconomic models: A critical review." *Journal of Monetary Economics* 4 (1): 1-44.
- Shiller, Robert. 2002. "From Efficient Market Theory to Behavioral Finance." Discussion Paper 1358, Cowles Foundation, New Haven, CT.
- Shin, Hyun Song, and Kwanho Shin. 2010. "Reshaping Global Economic Governance and the Role of Asia in G20." Presented at the ADB/Peterson Institute Conference, Washington DC., 20 April.
- Stiglitz, Joseph, and Bruce Greenwald. 2003. *Towards a New Paradigm in Monetary Economics*. Cambridge: Cambridge University Press.
- Tirole, Jean. 1982. "On the Possibility of Speculation under Rational Expectations." *Econometrica* 50 (5): 1163-1181.
- Tirole, Jean. 1985. "Asset Bubbles and Overlapping Generations." *Econometrica* 53 (5): 1071-1100.

Thorbecke, Erik, et al. 1992. *Adjustment and Equity in Indonesia*. Development Centre Studies, Organisation for Economic Co-operation and Development (OECD), Paris.

Tobin, James. 1970. "A General Equilibrium Approach to Monetary Theory." *Journal of Money, Credit and Banking* 2 (November): 461-472.

APPENDIX

List of Equations for the FCGE Model

Prices

$$PM_i = PWM_i \cdot EXR \cdot (1 + tm_i + ttf_i - submsh_i) \quad (1)$$

$$PE_i = (PWE_i \cdot EXR) / (1 - subesh_i) \quad (2)$$

$$PQ_i = [PD_i \cdot D_i + PM_i \cdot M_i] / Q_i \quad (3)$$

$$PX_i = [(1 - tdom_i - ttd_i - impf_i) \cdot PD_i \cdot D_i + PE_i \cdot E_i + SUB_i] / X_i \quad (4)$$

$$PV_i = [PX_i \cdot X_i - PINTM_i \cdot INTM_i] / VA_i \quad (5)$$

$$PINTM_i = [PDINTM_i \cdot DINTM_i + PFINTM_i \cdot FINTM_i] / INTM_i \quad (6)$$

$$PDINTM_i = \sum_j aad_{j,i} \cdot PQ_j \quad (7)$$

$$PFINTM_i = \sum_j aaf_{j,i} \cdot PQ_j \quad (8)$$

$$PK_i = \sum_j capmat_{j,i} \cdot PQ_j \quad (9)$$

$$PINDEX = GDP / RGDP \quad (10)$$

Market Distortion

$$DTTM_i = ttd_i \cdot PD_i \cdot D_i \quad (11)$$

$$FTTM_i = ttf_i \cdot PWM_i \cdot M_i \cdot EXR \quad (12)$$

$$TTM_i = DTTM_i + FTTM_i \quad (13)$$

$$TTMX_i = ttx_i \cdot \sum_j TTM_j \quad (14)$$

$$INDTAX_i = tdom_i \cdot PD_i \cdot D_i \quad (15)$$

$$TARIFF_i = tm_i \cdot PWM_i \cdot M_i \cdot EXR \quad (16)$$

$$IMPERFECT_i = impf_i \cdot PD_i \cdot D_i \quad (17)$$

$$SUBE_i = subesh_i \cdot PE_i \cdot E_i \quad (18)$$

$$SUBM_i = submsh_i \cdot PWM_i \cdot M_i \cdot EXR \quad (19)$$

Production and Intermediate Input

$$X_i = ax_i \cdot [bx_i \cdot (VA_i)^{-\rho x_i} + (1 - bx_i) \cdot (INTM_i)^{-\rho x_i}]^{-1/\rho x_i} \quad (20)$$

$$INTM_i = VA_i \cdot [(PV_i / PINTM_i) \cdot ((1 - bx_i) / bx_i)]^{1/(1+\rho x_i)} \quad (21)$$

$$VA_i = avx_i \cdot av_i \cdot [\sum_f bv_{i,f} \cdot (FACDEM_{i,f})^{-\rho v_i}]^{-1/\rho v_i} \quad (22)$$

$$INTM_i = at_i \cdot [bt_i \cdot (DINTM_i)^{-\rho t_i} + (1 - bt_i) \cdot (FINTM_i)^{-\rho t_i}]^{-1/\rho t_i} \quad (23)$$

$$INTM_i = DINTM_i, \quad \text{for } FINTM_0 = 0 \quad (24)$$

$$FINTM_i = DINTM_i \cdot [(PDINTM_i/PFINTM_i) \cdot (1 - bt_i/bt_i)]^{1/(1+\rho t_i)} \quad (25)$$

$$INTQ_i = \sum_j (aad_{i,j} \cdot DINTM_j + aaf_{i,j} \cdot FINTM_j) \quad (26)$$

$$Q_i = am_i \cdot [bm_i \cdot (D_i)^{-\rho m_i} + (1 - bm_i) \cdot (M_i)^{-\rho m_i}]^{-1/\rho m_i} \quad (27)$$

$$Q_i = D_i, \quad \text{for } M_0 = 0 \quad (28)$$

$$M_i = D_i \cdot [(PD_i/PM_i) \cdot ((1 - bm_i)/bm_i)]^{1/(1+\rho m_i)} \quad (29)$$

$$X_i = ae_i \cdot [be_i \cdot D_i^{\rho e_i} + (1 - be_i) \cdot E_i^{\rho e_i}]^{1/\rho e_i} \quad (30)$$

$$X_i = D_i, \quad \text{for } E_0 = 0 \quad (31)$$

$$E_i = D_i \cdot [(PE_i/((1 - tdom_i - ttd_i - impf_i) \cdot PD_i)) \cdot (be_i/(1 - be_i))]^{1/(\rho e_i - 1)} \quad (32)$$

Labor Market and Migration

$$FACDEM_{i,f} = VA_i \cdot [(bv_{i,f} \cdot PV_i)/(WF_f \cdot WFDIST_{i,f} \cdot (avx_i \cdot av_i)^{\rho v_i})]^{1/(1+\rho v_i)} \quad (33)$$

$$WAGES_i = (PINDEX)^{vp_i} \cdot (PV_i/PV_0)^{1-vp_i} \cdot [(X_i/\sum_{fl} FACDEM_{i,fl})/PDLO_i]^{\theta_i} \quad (34)$$

$$WF_{fl} = WF_0 \cdot \sum_i WAGES_i \cdot wlshare_{i,fl} \quad (35)$$

$$YF_f = \sum_i (WF_i \cdot WFDIST_{i,f} \cdot FACDEM_{i,f}) + \sum_{fr} YFROW_{f,fr} \quad (36)$$

$$MIGMATR_{fl,ffl} = \gamma_0 \cdot \left(\frac{\sum_i FACDEM_{i,fl}/\sum_i FACDEM_{0i,fl}}{\sum_i FACDEM_{i,ffl}/\sum_i FACDEM_{0i,ffl}} \right)^{\gamma_{1fl}} \quad (37)$$

$$\sum_{ffl} MIG_{fl,ffl} = \sum_{ffl} (LSUP \cdot (MIGMATR_{fl,ffl} - ONE_{fl,ffl})) \quad (38)$$

$$\sum_{ffl} \sum_{fl} MIG_{fl,ffl} = \sum_{fl} \sum_{ffl} MIG_{fl,ffl} \quad (39)$$

Income

$$INC_{ngi} = \sum_f (factoin_{ngi,f} \cdot YF_f) + \sum_{in2} ITRAN_{ngi,in2} \quad (40)$$

$$INC_{urrh} = \sum_f (factoin_{urrh,f} \cdot YF_f) + \sum_{in2} ITRAN_{urrh,in2} - \sum_{gin} ITRANB_{urrh,gin} \quad (41)$$

$$INC_{gin} = \sum_f (factoin_{gin,f} \cdot YF_f) + \sum_{in2} ITRAN_{gin,in2} + \sum_i (INDTAX_i + TARIFF_i) + \sum_{gin} ITRANB_{urrh,gin} \quad (42)$$

$$INC_{fr} = \sum_f (factoin_{fr,f} \cdot YF_f) + \sum_{in2} ITRAN_{fr,in2} + \sum_i (PWM_i \cdot M_i \cdot EXR) \quad (43)$$

$$DIRTAX_{gin,din} = dtax_{gin,din} \cdot INC_{din} \quad (44)$$

Inter-institution Transfer

$$ITRAN_{in,in2} = GTRAN_{in,in2} + RTRAN_{in,in2} + OTRAN_{in,in2} \quad (45)$$

$$GTRAN_{gin,din} = DIRTAX_{gin,din} \quad (46)$$

$$RNshare_{in} = \sum_{asrn} (RN_{asrn} \cdot AssetSLag_{asrn,in}) / \sum_{asrn,in2} (RN_{asrn} \cdot AssetSLag_{asrn,in2}) \quad (47)$$

$$RTRAN_{in,in2} = RNshare_{in} \cdot \sum_{asrn} (RN_{asrn} \cdot LiabSLag_{in2,asrn}) \quad (48)$$

Expenditure and Saving

$$MPS_h = amh_h \cdot ((1 + rna1_h) / (1 + rna10_h))^{bmh_h} \quad (49)$$

$$YCONS_h = (INC_h - \sum_{gin} DIRTAX_{gin,h}) \cdot (1 - MPS_h) - \sum_{ngi} ITRAN_{ngi,h} - \sum_{fr} ITRAN_{fr,h} \quad (50)$$

$$EXPD_{nni} = \sum_{in} ITRAN_{in,nni} \quad (51)$$

$$EXPD_h = YCONS_h + \sum_{gin} DIRTAX_{gin,h} + \sum_{ngi} ITRAN_{ngi,h} + \sum_{fr} ITRAN_{fr,h} \quad (52)$$

$$EXPD_{gin} = \sum_i (PQ_i \cdot GD_i) + \sum_{in} ITRAN_{in,gin} + \sum_i (SUB_i + SUBE_i + SUBM_i) \quad (53)$$

$$EXPD_{fr} = \sum_i (PWE_i \cdot E_i \cdot EXR) + \sum_f YFROW_{f,fr} + \sum_{in} ITRAN_{in,fr} \quad (54)$$

$$SAV_{din} = INC_{din} - EXPD_{din} \quad (55)$$

$$SAVING = \sum_{in} SAV_{in} \quad (56)$$

$$FSAV = \sum_{fr} SAV_{fr} / EXR \quad (57)$$

Investment and Aggregate Demand

$$INVES_{i,firm} = \lambda 0_{i,firm} \cdot (VA_i)^{\lambda 1_i} \cdot (1 + ss_{firm})^{\lambda 2_i} \cdot (EXR)^{\lambda 3_i} \quad (58)$$

$$INVEST = \sum_{i,in} INVES_{i,in} \quad (59)$$

$$CD_i = (\sum_h (\alpha q_{i,h} \cdot YCONS_h)) / PQ_i \quad (60)$$

$$DK_i = (kshr_i \cdot INVEST) / PK_i \quad (61)$$

$$ID_i = \sum_j capmat_{i,j} \cdot DK_j \quad (62)$$

Real Sector Equilibrium

$$Q_i = INTQ_i + CD_i + GD_i + ID_i + TTMX_i / PQ_i \quad (63)$$

$$FS_f = \sum_i FACDEM_{i,f} \quad (64)$$

$$LSUP = LSUP_0 \cdot (1 + \sum_{fl} lgrow_{fl}) + \sum_{fl,ffl} MIG_{fl,ffl} \quad (65)$$

$$UEMPR = (LSUP - \sum_{fl} FS_{fl}) / LSUP \quad (66)$$

$$SAV_{fr} = (\sum_f (factoin_{fr,f} \cdot YF_f) + \sum_{in2} ITRAN_{fr,in2} + \sum_i (PWM_i \cdot M_i \cdot EXR)) - (\sum_i (PWE_i \cdot E_i \cdot EXR) + \sum_f YFROW_{f,fr} + \sum_{in} ITRAN_{in,fr}) \quad (67)$$

Gross Domestic Product

$$GDP = \sum_i (PV_i \cdot VA_i + IND TAX_i + TARIFF_i - SUB_i - SUBM_i) \quad (68)$$

$$RGDP = \sum_i (CD_i + GD_i + ID_i) + (\sum_{ie} E_{ie}) - (\sum_{im} (1 - TMREAL0_{im}) \cdot M_{im}) \quad (69)$$

Poverty Line

$$PDAVG = (\sum_i PD_i \cdot D_i) / \sum_i D_i \quad (70)$$

$$PL_{ph} = (PINDEX / PDAVG) \cdot (\sum_i \alpha pov_{i,ph} \cdot PD_i) \quad (71)$$

$$PLTOT = (PINDEX / PDAVG) \cdot (\sum_i \alpha pov_i \cdot PD_i) \quad (72)$$

Financial Market Equilibrium

$$AssetS_{as,in} = AssetSLag_{as,in} + Asset_{as,in} \quad (73)$$

$$LiabS_{in,as} = LiabSLag_{in,as} + Liab_{in,as} \quad (74)$$

$$FixAS_{in} = FixASLag_{in} + FixA_{in} \quad (75)$$

$$Wealth_{in} = WealthLag_{in} + WealF_{in} \quad (76)$$

$$FixA_{in} = \sum_i INVES_{i,in} \quad (77)$$

$$WealF_{in} = SAV_{in} \quad (78)$$

$$\sum_{as} Asset_{as,in} + FixA_{in} = \sum_{as} Liab_{in,as} + WealF_{in} \quad (79)$$

$$rna1_{in} = (\sum_{asdp} (RN_{asdp} \cdot AssetS_{asdp,in})) / \sum_{asdp} AssetS_{asdp,in} \quad (80)$$

$$rnv1_{in} = (\sum_{nasmd} (RN_{nasmd} \cdot AssetS_{nasmd,in})) / \sum_{nasmd} AssetS_{nasmd,in} \quad (81)$$

$$AvgRN = (\sum_{as,in} (RN_{as} \cdot AssetS_{as,in})) / \sum_{as,in} AssetS_{as,in} \quad (82)$$

Demand and Supply of Financial Assets

$$Asset_{asfxr,FN-CenBank} = Liab_{ROW,asfxr} \quad (83)$$

$$MD_{in} = \alpha 1_{in} \cdot (INC_{in})^{\alpha 2_{in}} \cdot (rnv1_{in})^{-\alpha 3_{in}} \quad (84)$$

$$Asset_{asmd,in} = mdshare_{asmd,in} \cdot MD_{in} \quad (85)$$

$$Liab_{in,asmd} = mdshr_{in,asmd} \cdot \sum_{in2} Asset_{amd,in2} \quad (86)$$

$$Asset_{ast1,in} = \theta 1_{ast1,in} \cdot (RN_{ast1} / RN Lag_{ast1})^{\sigma 1_{ast1,in}} \quad (87)$$

$$Liab_{in,ast1} = ast1shr_{in,ast1} \cdot \sum_{in2} Asset_{ast1,in2} \quad (88)$$

$$Liab_{in,ast2} = \theta_{2in,ast2} \cdot (RN_{ast2}/RNLag_{ast2})^{\sigma_{2in,ast2}} \quad (89)$$

$$Asset_{ast2,in} = ast2shr_{ast2,in} \cdot \sum_{in2} Liab_{in2,ast2} \quad (90)$$

$$Asset_{ast3,in} = \theta_{1ast3,in} \cdot (RN_{ast3}/RNLag_{ast3})^{\sigma_{1ast3,in}} \quad (91)$$

$$\sum_{in} Liab_{in,ast3} = \sum_{in} Asset_{ast3,in} \quad (92)$$

$$Asset_{ast4,in} = \theta_{1ast4,in} \cdot (RN_{ast4}/RNLag_{ast4})^{\sigma_{1ast4,in}} \quad (93)$$

$$\sum_{in} Liab_{in,ast4} = \sum_{in} Asset_{ast4,in} \quad (94)$$

$$Liab_{GOVT,aste} = \theta_{2GOVT,aste} \cdot (RN_{aste}/RNLag_{aste})^{\sigma_{2GOVT,aste}} \quad (95)$$

$$\sum_{in} Liab_{in,astq} = \sum_{in} Asset_{astq,in} \quad (96)$$

Tobin Portfolio Allocation

$$RNFXR = (\sum_{asf, in} (RN_{asf, in} \cdot AssetS_{asf, in})) / \sum_{asf, in} AssetS_{asf, in} \quad (97)$$

$$RNDP = (\sum_{asdp, in} (RN_{asdp} \cdot AssetS_{asdp, in})) / \sum_{asdp, in} AssetS_{asdp, in} \quad (98)$$

$$RNSBI = (\sum_{assbi, in} (RN_{assbi} \cdot AssetS_{assbi, in})) / \sum_{assbi, in} AssetS_{assbi, in} \quad (99)$$

$$RNGb = (\sum_{asgb, in} (RN_{asgb} \cdot AssetS_{aseq, in})) / \sum_{aseq, in} AssetS_{aseq, in} \quad (100)$$

$$RNSEC = (\sum_{assec, in} (RN_{assec} \cdot AssetS_{assec, in})) / \sum_{assec, in} AssetS_{assec, in} \quad (101)$$

$$RNCR = (\sum_{ascr, in} (RN_{ascr} \cdot AssetS_{ascr, in})) / \sum_{ascr, in} AssetS_{ascr, in} \quad (102)$$

$$RNEQ = (\sum_{aseq, in} (RN_{aseq} \cdot AssetS_{aseq, in})) / \sum_{aseq, in} AssetS_{aseq, in} \quad (103)$$

$$RNNDP = (\sum_{asgb, in} (RN_{asgb} \cdot AssetS_{asgb, in}) + \sum_{assec, in} (RN_{assec} \cdot AssetS_{assec, in}) + \sum_{aseq, in} (RN_{aseq} \cdot AssetS_{aseq, in})) / (\sum_{asgb, in} AssetS_{asgb, in} + \sum_{assec, in} AssetS_{assec, in} + \sum_{aseq, in} AssetS_{aseq, in}) \quad (104)$$

$$RNNEQ = (\sum_{asgb, in} (RN_{asgb} \cdot AssetS_{asgb, in}) + \sum_{assec, in} (RN_{assec} \cdot AssetS_{assec, in})) / (\sum_{asgb, in} AssetS_{asgb, in} + \sum_{assec, in} AssetS_{assec, in}) \quad (105)$$

$$gh1_{rh} / (1 - gh1_{rh}) = \varphi_{1rh} \cdot ((1 + RNDP) / (1 + RNNDP))^{esp_{h1rh}} \quad (106)$$

$$gh2_{urh} / (1 - gh2_{urh}) = \varphi_{2urh} \cdot ((1 + RNEQ) / (1 + RNNEQ))^{esp_{h2urh}} \quad (107)$$

$$\sum_{asdp} Asset_{asdp, rh} = gh1_{rh} \cdot WEALH_{rh} - FixA_{rh} - MDH_{rh} - \sum_{assbi} Asset_{assbi, rh} - \sum_{asgb} Asset_{asgb, rh} - \sum_{ascr} Asset_{ascr, rh} - \sum_{aso} Asset_{aso, rh} \quad (108)$$

$$\sum_{aseq} Asset_{aseq, rh} = gh2_{rh} \cdot (1 - gh1_{rh}) \cdot WEALH_{rh} - FixA_{rh} - MDH_{rh} - \sum_{assbi} Asset_{assbi, rh} - \sum_{asgb} Asset_{asgb, rh} - \sum_{ascr} Asset_{ascr, rh} - \sum_{aso} Asset_{aso, rh} \quad (109)$$

$$\sum_{assec} Asset_{assec, rh} = (1 - gh2_{rh}) \cdot (1 - gh1_{rh}) \cdot WEALH_{rh} - FixA_{rh} - MDH_{rh} - \sum_{assbi} Asset_{assbi, rh} - \sum_{asgb} Asset_{asgb, rh} - \sum_{ascr} Asset_{ascr, rh} - \sum_{aso} Asset_{aso, rh} \quad (110)$$

$$WEALCB_{cbank} = \sum_{as} Asset_{as,cbank} + FixA_{cbank} \quad (111)$$

$$WEALBANK_{bank} = \sum_{as} Asset_{as,bank} + FixA_{bank} \quad (112)$$

$$WEALFIRM_{firm} = \sum_{as} Asset_{as,firm} + FixA_{firm} \quad (113)$$

$$WEALGOV_{gin} = \sum_{as} Asset_{as,gin} + FixA_{gin} \quad (114)$$

$$WEALH_h = \sum_{as} Asset_{as,h} + FixA_h \quad (115)$$

$$WEALROW_{fr} = \sum_{as} Asset_{as,fr} + FixA_{fr} \quad (116)$$

Money Market Equilibrium

$$CC = \sum_{ascc,in} Asset_{ascc,in} / \sum_{asmd,in} Asset_{asmd,in} \quad (117)$$

$$MULT = 1 / (CC + rr \cdot (1 - CC)) \quad (118)$$

$$M2S = MULT \cdot RM \quad (119)$$

$$MDIN_{in} = \sum_{asmd,in} Asset_{asmd,in} \quad (120)$$

$$M2D = \sum_{in} MDIN_{in} + \sum_{asdp,in} Asset_{asdp,in} \quad (121)$$

$$M2S = M2D \quad (122)$$

Credit Channel

$$BB1 = \frac{\sum_{assbi,bank} AssetS_{assbi,bank} / \sum_{as,bank} AssetS_{as,bank} + \sum_{asgb,bank} AssetS_{asgb,bank} / \sum_{as,bank} AssetS_{as,bank}}{\sum_{as,bank} AssetS_{as,bank}} \quad (123)$$

$$BANKF = (1 - BB1) \cdot \sum_{as,bank} Asset_{as,bank} \quad (124)$$

$$BANKLOAN_{firm} = lnshare_{firm} \cdot BANKF \quad (125)$$

$$SS_{firm} = \frac{BANKLOAN_{firm}}{\left(BANKF \cdot \left(\frac{WealF_{firm}}{\sum_{as}(Asset_{as,firm} + FixA_{firm})} \right)^{ss1_{firm}} \cdot \left(\frac{\sum_{assbi,bank} AssetS_{assbi,bank}}{\sum_{as,bank}(AssetS_{as,bank} + FixA_{bank})} \right)^{ss2_{firm}} \cdot \left(\frac{\sum_{asgb,bank} AssetS_{asgb,bank}}{\sum_{as,bank}(AssetS_{as,bank} + FixA_{bank})} \right)^{ss2_{firm}} \cdot \left(\frac{\sum_{bank} WealF_{bank}}{\sum_{as,bank}(Asset_{as,bank} + FixA_{bank})} \right)^{ss3_{firm}} \right)} \quad (126)$$

$$CCLOAN_{firm} = SS_{firm} \cdot BANKF \quad (127)$$

Equation of Motion

$$KSTOCK = (1 - DEPRATE) \cdot KSTOCKLag + KRATE \cdot TIDLag \quad (128)$$

$$FS_{NLABOR} = KSTOCK \quad (129)$$

Subscript

<i>i, j</i>	Production sector
<i>dcom, dcom₂</i>	Domestic commodities
<i>mcom, mcom₂</i>	Import commodities
<i>f, ff</i>	Factor of production
<i>fl, ffl</i>	Labor factor
<i>nfl</i>	Non-labor factor
<i>in, in₂, in₃</i>	Institution
<i>din</i>	Domestic institution
<i>ngi</i>	Domestic non-government institution
<i>nni</i>	Domestic non-government non-household institution
<i>cbank</i>	Central bank
<i>bank</i>	Domestic commercial bank
<i>firm</i>	Domestic non-bank firms
<i>gin, gin₂</i>	Government
<i>h, h₂</i>	Household
<i>ph</i>	Low-income household
<i>rh</i>	High-income household
<i>ruh</i>	Rural household
<i>urh</i>	Urban household
<i>fr, fr₂</i>	Foreign institution
<i>as</i>	Financial asset
<i>asfxr</i>	Foreign reserves
<i>ascc</i>	Currency
<i>asmd</i>	Money demand (currency and demand deposit)
<i>asdp</i>	Saving and domestic time deposit
<i>assbi</i>	Central bank certificates (SBI)
<i>asgb</i>	Government bond
<i>assec</i>	Long-term securities and short-term commercial paper
<i>ascr</i>	Credit
<i>aseq</i>	Equities
<i>aso</i>	Insurance, pension fund, and other non-tradable asset

$ast1$	Subset of financial assets that determines the demand of asset
$ast2$	Subset of financial assets that determines the supply of asset
$aste$	Subset of financial asset with a fixed demand or supply of asset
$astq$	Subset of financial asset that equilibrates the demand and supply of asset
$asrn$	Return-earning asset
$asrsk$	Risk asset
$nasrsk$	Non-risk asset
$nasmd$	Non-money demand asset (i.e., not currency and demand deposit)

Notation for Variables

Prices

PM_i	Domestic price of import
PE_i	Domestic price of export
PWM_i	World price of import
PWE_i	World price of import
EXR	Exchange rate (domestic to foreign currency)
PQ_i	Price of composite good
PD_i	Price of domestic good
PX_i	Price of domestic output
PV_i	Price of value added
$PINTM_i$	Price of intermediate composite
$PDINTM_i$	Price of domestic intermediate input
$PFINTM_i$	Price of imported intermediate input
PK_i	Price of capital investment
$PINDEX$	Producer price index

Market Distortion

$DTTM_i$	Domestic trade and transportation margin (paid)
$FTTM_i$	Import trade and transportation margin (paid)
TTM_i	Trade and transportation margin (paid)
$TTMX_i$	Trade and transportation margin (received)

$INDTAX_i$	Total indirect tax from commodities
$TARIFF_i$	Total tariff revenue
$TMREAL_i$	Tariff and trade and transportation margin in real value
$IMPERFECT_i$	Imperfect competition distortion
SUB_i	Sector subsidy
$SUBE_i$	Subsidy for export
$SUBM_i$	Subsidy for import

Production and Intermediate Input

X_i	Domestic production output
VA_i	Value added goods
$INTM_i$	Demand for intermediate composite input
$DINTM_i$	Domestic intermediate input
$FINTM_i$	Import intermediate input
Q_i	Final composite goods quantity (domestic and import)
D_i	Domestic sales quantity
M_i	Import quantity
E_i	Export quantity
$INTQ_i$	Supply of intermediate composite input
avx_i	Productivity accelerator

Labor Market and Migration

$FACDEM_i$	Factor demand
WF_f	Factor price
$WFDIST_{i,f}$	Factor price distortion
$WAGES_f$	Labor wage
PDL_i	Ratio of output to labor input (average productivity)
YF_f	Factor income
$YFROW_{f,fr}$	Remittance in foreign currency (<i>ROW</i> to factor)
$MIGMATR_{f,ff}$	Factor demand change

$MIG_{f,ff}$	Labor migration
$lgrow_f$	Growth rate of labor force

Income

INC_{ngi}	Non-government institution income
INC_{urrrh}	Urban non-poor household income
INC_{gin}	Government revenue
INC_{fr}	Rest of the world income
$DIRTAX_{gin,din}$	Direct income tax

Inter-institution Transfer

$ITRAN_{in,in2}$	Total monetary transfer among institutions
$GTRAN_{gin,din}$	Monetary transfer to government (direct taxes)
$RTRAN_{in,in2}$	Monetary return from the financial assets (interest payments and dividends)
$OTRAN_{in,in2}$	Other monetary transfer among institutions
$RNshare_{in}$	Share of return-earning assets for each institution

Expenditure and Saving

MPS_h	Marginal propensity to save
$YCONS_h$	Household consumption
$EXPD_{nni}$	Domestic non-government non-household institution expenditure
$EXPD_{gin}$	Government expenditure
$EXPD_{fr}$	Rest of the world expenditure
SAV_{din}	Domestic institution saving
$SAVING$	Aggregate saving
$FSAV$	Foreign saving
SAV_{fr}	Foreign saving in domestic currency

Investment and Aggregate Demand

$INVES_{i,in}$	Fixed investment by institution to sector of destination
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$INVEST$	Gross investment
DK_i	Quantity of capital investment
CD_i	Private consumption demand
ID_i	Investment demand
GD_i	Government demand

Real Sector Equilibrium

FS_f	Factor supply
$LSUP$	Total labor supply
$UEMP$	Total open unemployment level

Gross Domestic Product

GDP	Nominal GDP (at current price)
$RGDP$	Real GDP (at constant price)

Poverty Line

$PDAVG$	Average domestic price
PL_{ph}	Poverty line
$PLTOT$	Poverty line of population

Financial Market Equilibrium

$AssetSLag_{as,in}$	Stock of asset (beginning of period)
$Asset_{as,in}$	Flow of asset
$AssetS_{as,in}$	Stock of asset (end of period)
$LiabSLag_{in,as}$	Stock of liabilities (beginning of period)
$Liab_{in,as}$	Flow of liabilities
$LiabS_{in,as}$	Stock of liabilities (end of period)
$FixASLag_{in}$	Stock of fixed asset (beginning of period)
$FixA_{in}$	Fixed asset (fixed investment)
$FixAS_{in}$	Stock of fixed asset (end of period)

$WealthLag_{in}$	Stock of wealth (beginning of period)
$WealF_{in}$	Flow of wealth (savings)
$Wealth_{in}$	Stock of wealth (end of period)

Demand and Supply of Financial Assets

RN_{as}	Rate of return
$rna1_{in}$	Composite interest rate for deposit
$rnv1_{in}$	Composite interest rate on non-money demand asset
$AvgRN$	Weighted average rate of return for all assets
MD_{in}	Stock of money demand asset (currency and demand deposit)

Tobin Portfolio Allocation

$RNFXR$	Rate of return on foreign reserve
$RNDP$	Rate of return on deposit
$RNSBI$	Rate of return on central bank certificates (SBI)
$RNGB$	Rate of return on government bond
$RNSEC$	Rate of return on long- and short-term corporate securities
$RNCR$	Rate of return on credit
$RNEQ$	Rate of return on equities
$RNNDP$	Rate of return on non-deposit assets
$RNNEQ$	Rate of return on non-equity assets
$gh1_h$	Share of deposit in household portfolio ($0 < gh1_h < 1$)
$gh2_h$	Share of equities in household portfolio ($0 < gh2_h < 1$)
$WEALCB_{cbank}$	Total wealth of central bank
$WEALBANK_{bank}$	Total wealth of commercial bank
$WEALFIRM_{firm}$	Total wealth of non-bank firms
$WEALGOV_{gin}$	Total wealth of government
$WEALH_h$	Total wealth of household
$WEALROW_{fr}$	Total wealth of foreign institution

Money Market Equilibrium

$MDIN_{in}$	Institution demand for money (flow)
MDH_h	Household demand for money (flow)
CC	Ratio of currency to money demand asset
$MULT$	Money multiplier
RM	Central bank's reserve money
$M2D$	Total money demand
$M2S$	Total money supply

Credit Channel

$BB1$	Share of SBI and government bond in bank's total asset
$BANKF$	Bank's loanable funds
$BANKLOAN_{firm}$	Bank loan to domestic non-bank firms
SS_{firm}	Ratio of loan to total loanable funds determined by credit channel mechanism
$CCLOAN_{firm}$	Bank loan to domestic non-bank firms by credit channel mechanism

Equation of Motion

$KSTOCK$	Capital stock
$KSTOCKLag$	Capital stock from previous period
$KRATE$	Capital accumulation rate
$TIDLag$	Total investment from previous period

Notation for Parameters

$tdom_i$	Indirect domestic tax rate
ttd_i	Domestic trade and transportation margin rate
$subesh_i$	Subsidy share to export
$submsh_i$	Subsidy share to import
tm_i	Import tariff rate
ttf_i	Import trade and transportation margin rate
ttx_i	Trade and transportation margin rate

$aad_{i,j}$	Input-output coefficients to domestic intermediate goods
$aaf_{i,j}$	Input-output coefficients to imported intermediate goods
vp_i	Wage function elasticity of price index
φ_i	Wage function elasticity of average productivity
$capmat_{i,j}$	Capital investment matrix
$sumcapmat_i$	Total capital investment
$wlshare_{i,f}$	Sector weight of labor wage
$ONE_{f,ff}$	Labor migration parameter
$factoin_{in,f}$	Factor income share to institution
$impf_i$	Imperfect competition index
$dtax_{gin,din}$	Direct tax rate
$\alpha q_{i,h}$	Cobb-Douglas consumption share parameter for composite goods
$kshr_i$	Share of capital investment
bx_i	Production output function share parameter
ax_i	Production output function shift parameter
ρx_i	Production output function elasticity
$bv_{i,f}$	Value added function share parameter by factor of production
$sumbv_i$	Total value added function share parameter
av_i	Value added function shift parameter
ρv_i	Value added function elasticity
bt_i	Armington function share parameter for intermediate goods
at_i	Armington function shift parameter for intermediate goods
ρt_i	Armington function elasticity for intermediate goods
be_i	Constant elasticity of transformation (CET) share parameter for domestic sale
ae_i	Constant elasticity of transformation (CET) shift parameter for domestic sale
ρe_i	Constant elasticity of transformation (CET) elasticity for domestic sale
bm_i	Constant elasticity of transformation (CET) share parameter for composite
am_i	Constant elasticity of transformation (CET) shift parameter for composite
ρm_i	Constant elasticity of transformation (CET) elasticity for composite goods
bmh_h	Marginal propensity to save share parameter
amh_h	Marginal propensity to save shift parameter

$ss1_{firm}$	Loan share parameter for firm's net worth ($ss1_{firm} < 0$)
$ss2_{firm}$	Loan share parameter for bank holding in SBI and bond ($ss2_{firm} > 0$)
$ss3_{firm}$	Loan share parameter for bank's net worth ($ss3_{firm} < 0$)
$\lambda0_{i,firm}$	Investment function shift parameter
$\lambda1_i$	Investment function share parameter for value added
$\lambda2_i$	Investment function share parameter for loan share
$\lambda3_i$	Investment function share parameter for exchange rate
$\gamma0_f$	Coefficient of labor migration
$\gamma1_f$	Elasticity of labor migration
$\alpha pov_{i,ph}$	Consumption pattern matrix
αpov_i	Total consumption pattern matrix
$\alpha1_{in}$	Money demand function shift parameter
$\alpha2_{in}$	Money demand function share parameter for income
$\alpha3_{in}$	Money demand function share parameter for non-money market asset
αh_h	Household money demand function shift parameter
$mdshare_{asmd,in}$	Share of currency and demand deposit in money demand asset
$mdshr_{in,asmd}$	Share of institution's holding in currency and demand deposit
$\sigma1_{ast1,in}$	Share parameter for demand of 'ast1' assets
$\sigma2_{in,ast2}$	Share parameter for supply of 'ast2' assets
$\theta1_{ast1,in}$	Shift parameter for demand of 'ast1' assets
$\theta2_{in,ast2}$	Shift parameter for supply of 'ast2' assets
$ast1shr_{in,ast1}$	Share of liabilities in institution (liabilities to total asset)
$ast2shr_{ast2,in}$	Share of asset in institution (asset to total liabilities)
$astqshr_{in,astq}$	Share of equilibrating asset in institution (liabilities to total asset)
$\varphi1_h$	Shift parameter of household's portfolio in deposit
$\varphi2_h$	Shift parameter of household's portfolio in equities
$esph1_h$	Share parameter of household's portfolio in deposit
$esph2_h$	Share parameter of household's portfolio in equities
rr	Bank's reserve requirement
$lnshare_{firm}$	Loan ratio for the private sector
$DEPRATE$	Capital stock depreciation rate